Assessment of the Diagnostic Accuracy of Ultrasound for the Detection of Rotator Cuff Tear With Respect to Magnetic Resonance Imaging

A Dissertation Submitted in Partial Fulfilment of M.D Radiodiagnosis

(Branch VIII) Examination of

THE TAMIL NADU Dr M.G.R MEDICAL UNIVERSITY, CHENNAI

To be held in April, 2015

C E RT I F I C A T E

This is to certify that the dissertation entitled "Assessment of the Diagnostic Accuracy of Ultrasound for the Detection of Rotator Cuff Tear with Respect to Magnetic Resonance Imaging" is the bonafide original work of Dr. Vanjare Harshad Arvind submitted in partial fulfilment of the requirement for M.D Radio Diagnosis (Branch- VIII) Degree Examination of The Tamil Nadu Dr M.G.R Medical University, Chennai to be conducted in April, 2015.

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Principal:

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DECLARATION

I, Dr. Vanjare Harshad Arvind, hereby declare that this dissertation entitled "Assessment of the Diagnostic Accuracy of Ultrasound for the Detection of Rotator Cuff Tear with Respect to Magnetic Resonance Imaging" is an original work done by me in partial fulfilment of the requirement for M.D Radio Diagnosis (Branch- VIII) Degree Examination of The Tamil Nadu Dr M.G.R Medical University, Chennai to be conducted in April, 2015.

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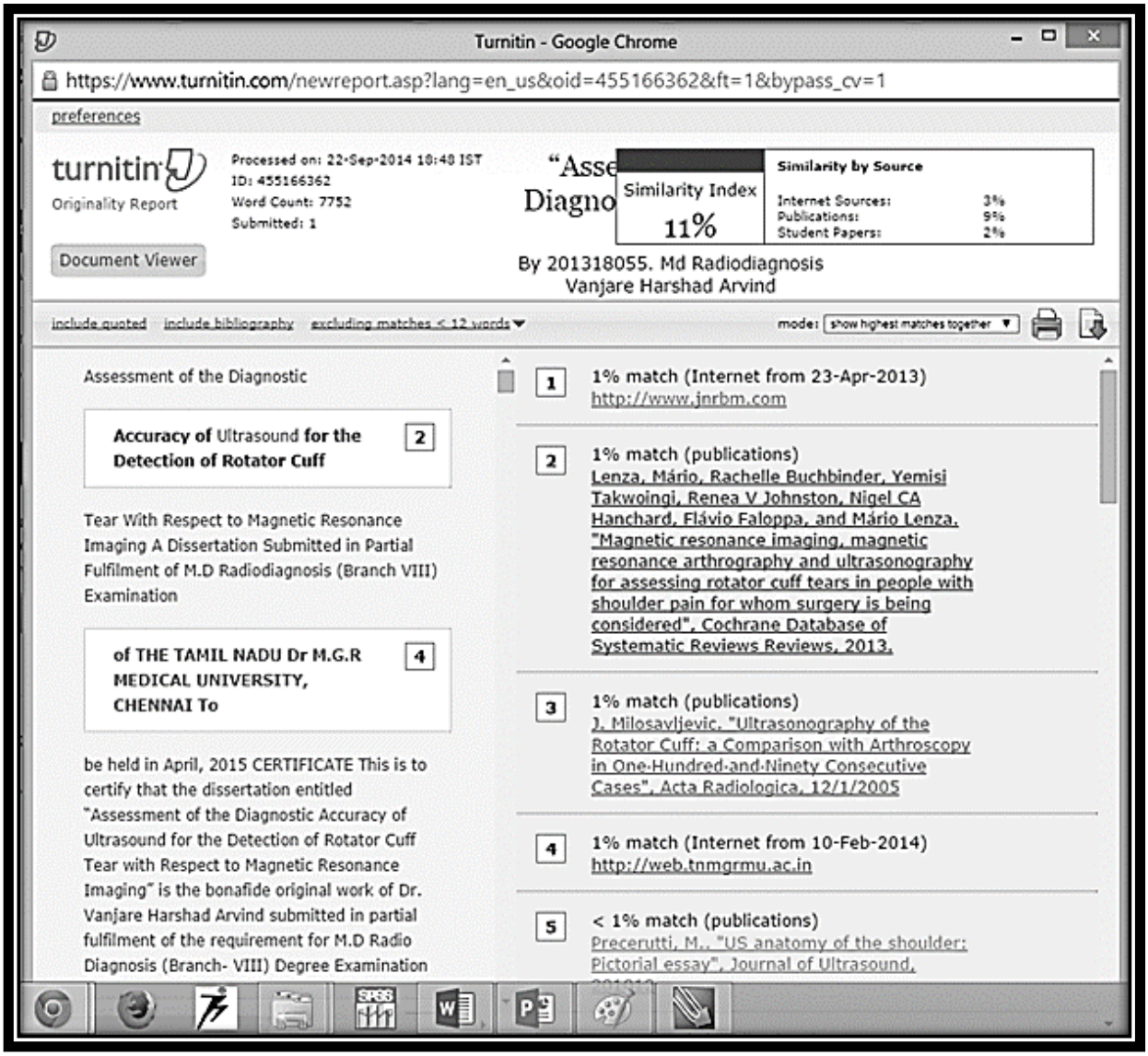
ORIGINALITY REPORT



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April 03, 2014

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Sub: **Fluid Research grant project:**
To assess the diagnostic accuracy of ultrasound for the detection of rotator cuff tears with respect to magnetic resonance imaging (MRI).
Dr. Vanjare Harshad Arvind, Radiodiagnosis, Dr. Jyoti Sureka, Radiodiagnosis, CMC, Vellore

Ref: IRB Min No: 8613 [DIAGNOSE] dated 07.01.2014

Dear Dr. Vanjare Harshad Arvind,

The Institutional Review Board (Blue, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project entitled "To assess the diagnostic accuracy of ultrasound for the detection of rotator cuff tears with respect to magnetic resonance imaging (MRI)." on January 7th 2014.

The Committees reviewed the following documents:

1. IRB Application format
2. Curricullum Vitae' of Drs. Vanjare Harshad Arvind, Jyoti Sureka
3. Information sheet (English, Tamil, Bengali, Telugu & Hindi)
4. Consent form (English, Tamil, Bengali, Telugu & Hindi)
5. Data Collection sheet
6. No of documents 1-5

The following Institutional Review Board (Blue, Research & Ethics Committee) members were present at the meeting held on January 7th 2014in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore 632002.

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We approve the project to be conducted as presented.

The Institutional Ethics Committee expects to be informed about the progress of the project, any **adverse events** occurring in the course of the project, any **amendments in the protocol and the patient information / informed consent**. On completion of the study you are expected to submit a copy of the **final report**. Respective forms can be downloaded from the following link: http://172.16.11.136/Research/IRB_Polices.html in the CMC Intranet and in the CMC website link address: http://www.cmch-vellore.edu/static/research/Index.html.

Yours sincerely

Dr. Nihal Thomas
Secretary (Ethics Committee)
Institutional Review Board

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CMC Vellore and all my teachers, for making this study and this course a reality. I am grateful most importantly to all the patients without whom this study would not have been possible.

My family, friends and colleagues for their love, constant support and encouragement.

Above all I thank, God for his abundant grace.

Contents:

Title of the abstract: Assessment of the Diagnostic Accuracy of Ultrasound for the Detection of Rotator Cuff Tear with Respect to Magnetic Resonance Imaging

Department: Radio Diagnosis, Christian Medical College, Vellore

Name of candidate: Vanjare Harshad Arvind

Degree and subject: MD Radio Diagnosis

Name of the guide: Dr. Jyoti Sureka, MBBS, MDRD, FRCR

Objectives:
To assess the sensitivity and specificity of ultrasound for the detection of rotator cuff tendon tear with respect to Magnetic Resonance Imaging (MRI).

Methods:
Study protocol was approved by the institutional review board. Sample size was calculated as 35 MRI positive cases for specificity of 80% for the test (ultrasound). Patients planned for MRI of shoulder were counselled for ultrasound of the same joint. 70 subjects (35 positive cases) were included. Ultrasound performer and MRI reporting doctor were blinded to the results of the other test. 2x2 tables were used to calculated sensitivity, specificity, positive and negative predictive value and accuracy of the test.

Results:
For the diagnosis of any rotator cuff tendon tear ultrasound showed sensitivity of 73.08%, specificity of 88.39%, negative predictive value of 90.73%, positive predictive value of 67.86% and accuracy of 84.54% with respect to MRI. For the diagnosis of any tear of the supraspinatus tendon ultrasound showed a sensitivity of 84% and specificity of 78.79%. Age and hypertension showed a significant association for the presence of supraspinatus tendon tear. For the diagnosis of subacromial and subdeltoid bursitis ultrasound showed a sensitivity of 81% and specificity of 42.86%.

Key words: ultrasound, rotator, cuff, tear, shoulder

Introduction:

Shoulder pain is a common condition with multiple causes. This includes rotator cuff tear, adhesive capsulitis, subacromial and subdeltoid bursitis, arthritis, tendinitis and fractures among others causes. Patients may present with insidious onset of symptoms or there can be acute presentation following lifting of heavy weight or trauma. Plain radiographic evaluation of the shoulder is often the initial modality of choice and it is useful to rule out any bony abnormality and soft tissue calcifications. However; radiograph are often normal and other imaging modalities may have to be used to come to a diagnosis. In this regard Magnetic Resonance Imaging (MRI) of the shoulder is used to evaluate for the causes of the shoulder pain. Given the exquisite quality of the images offered by MRI; MRI has long been a favoured imaging modality for evaluation of the shoulder joint. It not only provides good anatomy of the shoulder muscles; but also images all the ligaments in exquisite detail which is not possible with other imaging tools.

Although MRI is good at imaging the shoulder joint, the high cost per scan and prolonged waiting period to perform these scans are factors that go against it. Patients are also expected to lie down still for prolonged duration during these studies which many individuals find difficult; especially if they are in pain. Also, dynamic movements cannot be assessed during these scans. Many patients present with only features of rotator cuff tear, and specific imaging for the ligamentous anatomy may not be needed. In this regard there is a need for an imaging tool that can be done quickly, is cost effective, has shorter waiting time and used to assess dynamic range of movements of the shoulder joint. Ultrasound is one such tool that fulfils all the above criteria.

Reason for choosing this research question:

- Although many studies have previously shown that ultrasound is a good imaging tool for the assessment of the rotator cuff tears; all such studies are done among western population and no Indian data exists in this regard.
- Most of the studies do not mention the transducer frequency used for the evaluation of the patients which has a big impact on the ultrasound diagnosis.
- The specially made high frequency musculoskeletal ultrasound transducers (14 – 16 MHz) are very costly and most Indian hospitals find it difficult to afford them.

Setting of the study:

- A 14 MHz frequency ultrasound transducer was used for evaluation of the shoulder joint.
- All the patients coming for shoulder MRI were counselled for the need for concurrent ultrasound evaluation also.
- Efforts were made to perform the ultrasound evaluation on the same day.

Aim:

To assess the diagnostic accuracy of ultrasound for the detection of rotator cuff tear with respect to Magnetic Resonance Imaging (MRI)

Objectives:

1. To assess the diagnostic accuracy of ultrasound for the detection of rotator cuff tear with respect to Magnetic Resonance Imaging (MRI)

2. To identify tendinopathic changes, partial thickness and full thickness rotator cuff tears and assess the sensitivity and specificity of ultrasound to diagnose each of them with respect to MRI

3. To assess common risk factor for rotator cuff tears among Indian population

Literature Review:

Overview of rotator cuff injuries:

Rotator cuff tears increase with increasing age; with more than 50% of individuals more than 80 years of age show rotator cuff tears. (1) In a study done by Yamamoto A, et al in Japan, 683 people (1,366 shoulders) with mean age of 57.9 years; from a mountain village were assessed for rotator cuff tears which showed a prevalence of 20.7% for rotator cuff tears. 36% of patients with symptoms had rotator cuff tear while 16.9% of individuals without symptoms had rotator cuff tear. (2)

In an another study involving asymptomatic women done by Abate M, et al in Italy; showed that the prevalence of rotator cuff tears was more among postmenopausal women (8.9%) as compared to premenopausal women (3.1%). (3)

A meta-analysis by Reilly P, et al showed that rotator cuff tears were common in cadaveric studies (2553 shoulders showed partial thickness tears in 18.49 % and full thickness tears in 11.75%, a total of 30.24% tears, with the mean age been 70.1 years). Ultrasound (USG) and Magnetic Resonance Imaging (MRI) studies were used to assess prevalence of rotator cuff tears in asymptomatic and symptomatic patients. Among the asymptomatic patients USG showed prevalence of rotator cuff tear in 38.9% of subjects with a sample size of 591 (partial thickness tear 17.2% and full thickness tear of 21.7%). While MRI showed prevalence of 26.2% with a sample size of 271 (partial thickness tear of 15.87% and full thickness tear of 10.33% - mean age of 44.3 years). While for the symptomatic patients; USG showed a prevalence of 41.4%

with a sample size of 1038 subjects (partial thickness tear 6.7% and full thickness tear of 34.7% - mean age of 50.4 years). MRI showed a prevalence of 49.38% with a sample size of 490 subjects (partial thickness tears 8.57% and full thickness tears 40.81% - mean age of 43.6 years). (4)

Epidemiological data with respect to rotator cuff tears is lacking in Indian population.

Impairment due to rotator cuff tears:

Rotator cuff tears cause restriction in activities of daily living. In one of the study by Nakajima et al from Japan; 924 shoulders in 462 individuals were evaluated. 99 shoulders had tear (mean age of 70.5 years) and 825 shoulders did not have tear (mean age of 60.2 years). Simple shoulder test (SST) was used as a marker of activities of daily living. The SST score was significantly lower in patients with rotator cuff tear ($P < 0.001$) as compared to those who did not have rotator cuff tear. Ability to sleep comfortably at night and to lift 3.6 kg of weight above the shoulder level showed a significant association. This was impaired in patients with rotator cuff tear. (5)

Risk factors for rotator cuff tears:

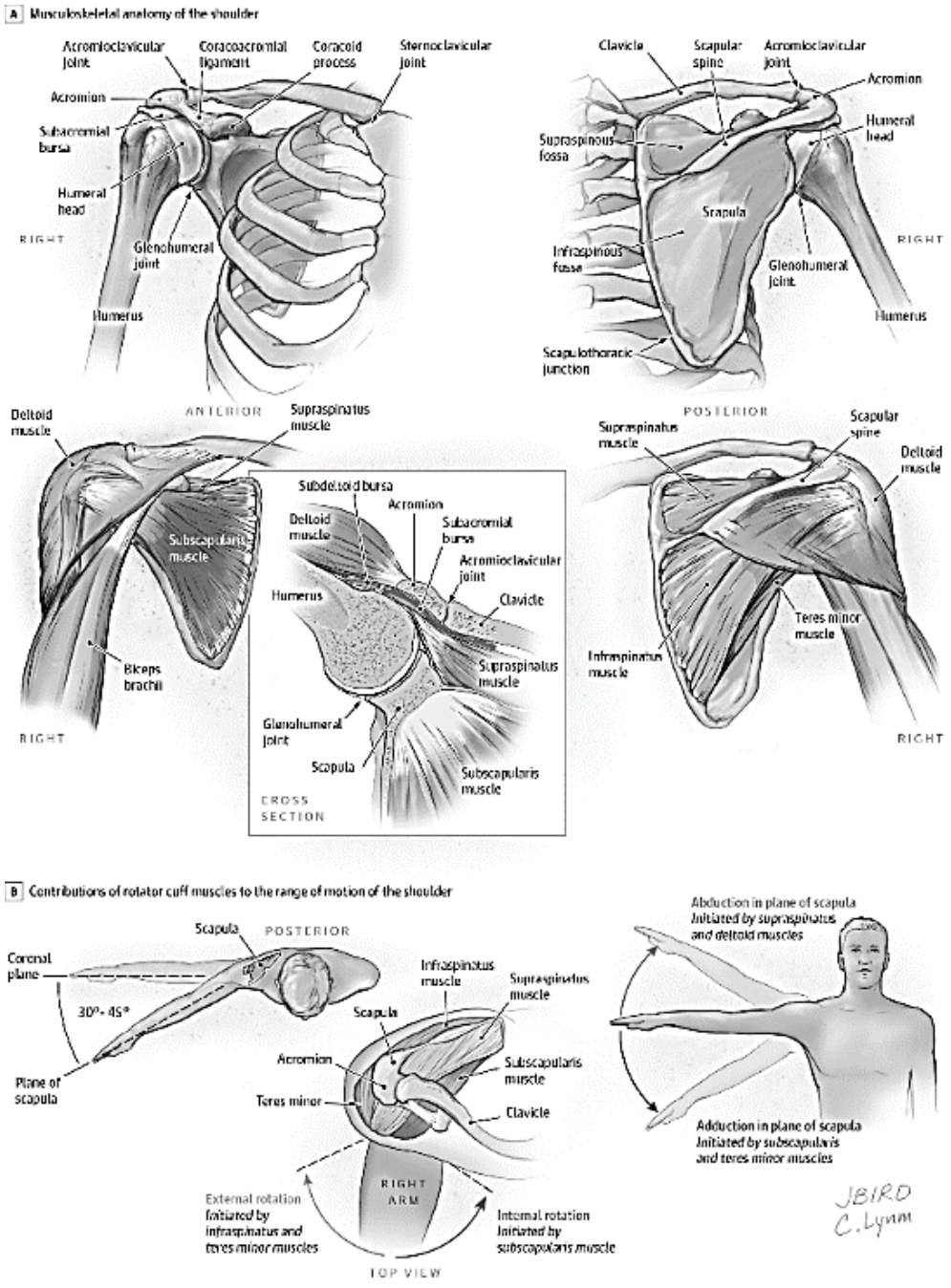
Risk factors for rotator cuff tears are multifactorial and can be divided into intrinsic and extrinsic factors. Intrinsic factor would include tendon degeneration, vascular microsupply and genetic factors; while extrinsic factors would include presence of os acromiale, morphology of acromion and coracoid process and spurs from the acromial process. (6)

Other common risk factors for rotator cuff tears are male gender, increased age, history of trauma and dominant arm (2)(7)(8)(9) higher body mass index (BMI) and lower high density lipoprotein cholesterol levels (HDL) in postmenopausal women. (3) Genetic variations (10) variability of coracoid morphology, (11) presence of arterial hypertension are other factors associated to rotator cuff tears. (12) Smoking increased the severity of rotator cuff tears. (13) Occupations that involve continuous arm elevation above the shoulder level and heavy lifting are associated with increased rates of rotator cuff tears (14); along with repetitive work and awkward posture. (15) Elevated serum cholesterol levels show positive correlation with rotator cuff tears. (16) Asymptomatic rotator cuff tears are more common along elderly diabetic patients and may be related to diabetes. (17)

Trauma:

In a prospective cohort study done by Valkering KP, el al from Netherlands; in which 217 patients were reassessed one year after shoulder trauma, 20 patients (9%) had symptomatic rotator cuff tears. (7) A retrospective study done by Horsley IG el al in Manchester, UK to assess shoulder pathologies among rugby players showed 2 or more pathologies in 75% of cases in a study population of 87 professional rugby players. A superior labrum anterior to posterior (SLAP) lesion was present in 83% of cases; while 43% of cases had rotator cuff tears. (8) In another study by Akbar M, et al who analysed rotator cuff tears in 100 paraplegic patients using wheelchair showed that in paraplegic patients rotator cuff tears were significantly more common; 63% as compared to 15% in 100 age and sex matched healthy volunteers. This was attributed to the repeated use of the wheelchair leading to rotator cuff trauma. (18)

Normal Anatomy of Shoulder Joint (19)



Musculoskeletal Anatomy of the Shoulder and Range of Motion Created by the Rotator Cuff Muscles

Figure 1 showing normal anatomy. (20)

Normal Anatomy of the Glenohumeral (Shoulder) Joint:

The glenohumeral joint is a multiaxial synovial lined joint formed by the nearly spherical head of the humerus and a very shallow genoid of the scapula. The convexity of the humeral head is more than the concavity of the glenoid which gives it the wider range of motion at the expense of joint stability. Hyaline cartilage lines both the articular surfaces which shows central thickening and peripheral thinning of the articular surface of humerus and is reverse on the glenoid fossa.

Glenoid labrum:

A fibrocartilaginous rim that surrounds the glenoid fossa is called the glenoid labrum. It varies is size and thickness; and is triangular in shape on cross section. Superiorly it blends with the long head of the biceps. Apart from the protection of bone it deepens the joint cavity, thus giving more stability to it. Some times its anterior and superior aspect may show some deficiency through which herniation of synovial membrane can occur.

Fibrous capsule:

A fibrous sheath that forms the fibrous capsule surrounds the glenohumeral joint. Medially, it is attached just outside the glenoid labrum and blends with the long head of the biceps tendon in the superior aspect. Laterally, the fibrous capsule attaches to the anatomical neck of the humerus; except in the inferior aspect where it attaches more than 1 cm inferiorly. The fibrous capsule receives support from the subscapularis, supraspinatus, infraspinatus, teres minor and long head of the triceps tendon. A triangular area of exposed capsule which is called the rotator

interval extends from the superior margin of the subscapularis to the anterior margin of the supraspinatus.

Ligaments:

The glenohumeral, coracohumeral and transverse humeral ligaments are related to the glenohumeral joint.

Glenohumeral ligaments:

The anterior and inferior aspect of the fibrous capsule is supported by the glenohumeral ligaments. They are different from the usual ligaments with respect to their decreased tensile strength; their main activity been to prevent excessive rotation of the humeral head. The glenohumeral ligaments are composed of the superior, middle and inferior glenohumeral ligaments. The superior glenohumeral ligament originates from the supraglenoid tubercle which is just anterior to the origin of the long head of biceps tendon and inserts into the proximal aspect of the lesser tubercle on the humerus. Along with coracohumeral ligament it prevents inferior displacement of the humerus. The middle glenohumeral ligaments is a fan shaped ligament which originates just anterior to the superior glenohumeral ligament and along the anterior margin of the glenoid rim; extending up to the lower third. It inserts into the lesser tubercle of the humerus along with the subscapularis tendon with which it blends. Anterior stability to the shoulder joint is provided by this ligament. The inferior glenohumeral ligament is a hammock shaped ligament which originates along the inferior margin of the glenoid rim running anterior to posteriorly. The anterior and superior aspect of the inferior glenohumeral ligament is thickened. Similar thickening is seen in the adjacent capsule to which it attaches to

form the axillary pouch. The anterior band is primarily considered to be a static stabiliser of the shoulder joint.

Coracohumeral ligament:

The coracohumeral ligament originates from the lateral aspect of the coracoid process and blends with the fibrous capsule to insert into the lesser and greater tubercles of humerus. The ligament has a tunnel shaped space for the long head of biceps tendon. It also merges partly into the superior glenohumeral ligament.

Transverse humeral ligament:

The lesser and greater tubercles of the humerus are traversed by a broad ligament which is called the transverse humeral ligament. It covers the long head of the biceps tendon which is present in the intertubercular groove.

Vascular supply and innervation:

The glenohumeral joint is supplied by the branches from suprascapular, anterior and posterior circumflex arteries while it is innervated by the suprascapular nerve, axillary nerve and lateral pectoral nerve.

Stability of the shoulder joint:

A large humeral head articulates with a shallow and small glenoid cavity to form the shoulder joint which is a cause of inherent instability. However; this is a natural compromise for increased shoulder movement. Presence of glenoid labrum, fibrous capsule, different ligaments and muscles aid in improved joint stability. While the glenoid labrum deepens the glenoid fossa; the ligaments provide stability in certain positions.

Rotator cuff in joint stability:

Tendons arising from supraspinatus, subscapularis, infraspinatus and teres minor muscles blend with the lateral aspect of the fibrous capsule to form the rotator cuff. The strong tendons of these muscles which form the rotator cuff provide a strong lateral support to the joint which maintains the appropriate glenohumeral alignment preventing lateral translocation of the joint and thus helps in joint stability. The long head of the biceps tendon that originates from the supraglenoid tubercle provides superior joint stability and the inferior joint stability is provided by the long head of the triceps tendon. However, the inferior aspect of the joint is the most unstable part of the glenohumeral joint.

Muscles of the rotator cuff:

Subscapularis muscle:

The subscapularis is a triangular shaped muscle that originates from the subscapular fossa (of the scapula) and inserted along the lesser tubercle of humerus. It also gives few fibres to the anterior joint capsule. The suprascapular, subscapular and axillary arterial branches provide vascular supply to it; while its innervation is supplied by the upper and lower subscapular nerves (C5 and 6). Its main action is medial rotation of the humerus apart from joint stability.

Supraspinatus muscle:

The supraspinatus muscle arises from the supraspinatus fossa (of scapula), predominantly from the medial two third aspect. It travels underneath the acromion and superior to the glenohumeral joint to insert into the superior aspect of the greater tubercle of the humerus. It also gives few fibres to the superior aspect of fibrous capsule. The suprascapular and dorsal scapular arterial branches supply the muscle; while it is innervated by the suprascapular nerve (C 5 and 6). Its main action is to initiate abduction of the glenohumeral joint following which it helps the deltoid muscle in full abduction. It also provides joint stability.

Infraspinatus muscle:

The infraspinatus muscle originates from the infraspinous fossa (of scapula), predominantly from the medial two third aspect. It travels underneath the spine of the scapula to insert in the greater tubercle of the humerus just inferior to the insertion of the supraspinatus muscle. The

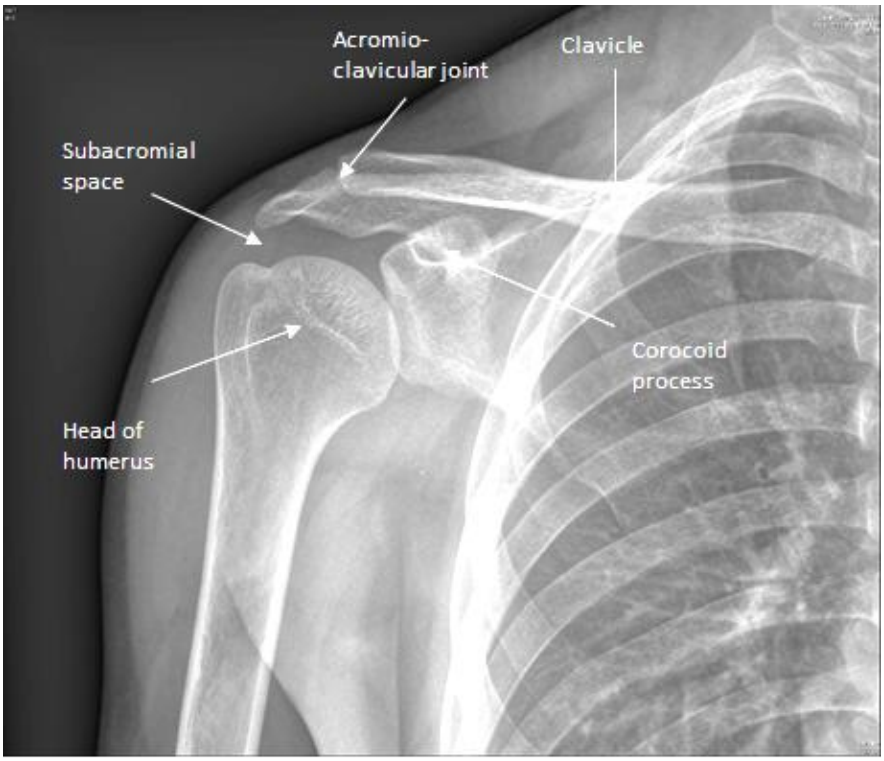
suprascapular and circumflex scapular arterial branches supply it; while it is innervated by the suprascapular nerve (C5 and 6). Its main function is lateral rotation of the humerus apart from providing joint stability. Sometimes the infraspinatus muscle may be fused with the teres minor muscle.

Teres minor muscle:

The teres minor muscle originates from the upper two third dorsal aspect of lateral border of scapula and inserts into the lower aspect of the greater tubercle of the humerus. It also gives few fibres to the inferior aspect of the fibrous capsule. The circumflex scapular and posterior circumflex humeral arterial branches supply the muscle; while it is innervated by the axillary nerve (C5 and 6). Its main action is lateral rotation of the humerus. It also provides joint stability with other rotator cuff muscles.

Normal Imaging Anatomy:

Plain radiograph of the right shoulder showing normal anatomy.



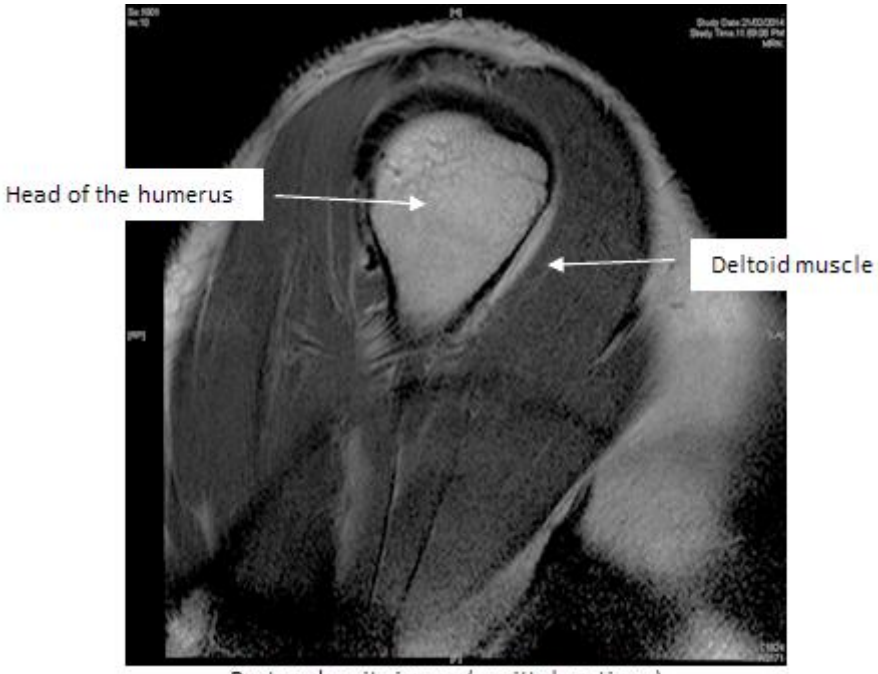
Radiograph of the right shoulder joint

Normal MRI anatomy of the shoulder joint:

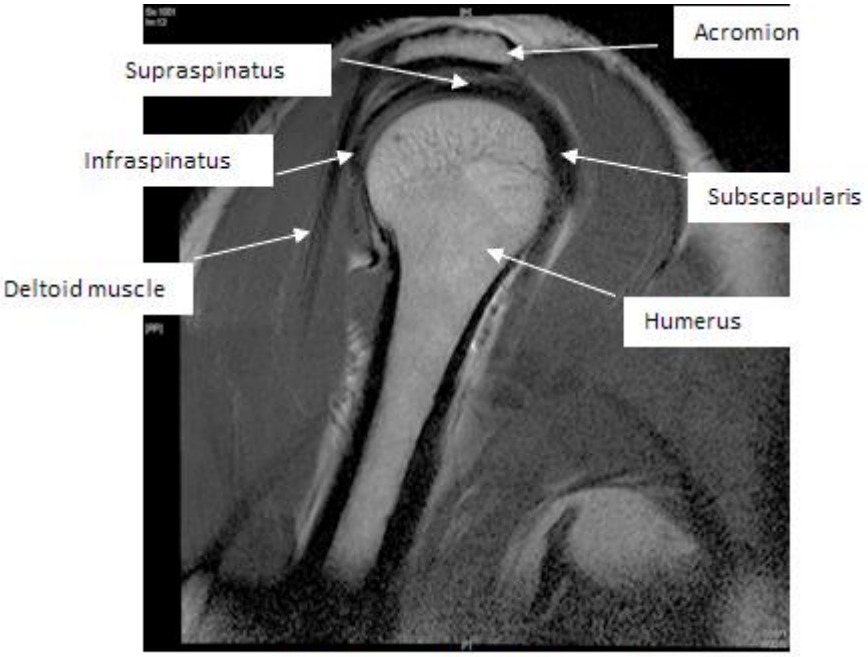
Proton density images (sagittal sections)

Proton density image (sagittal sections)

Proton density image (sagittal sections)



Proton density image (sagittal sections)



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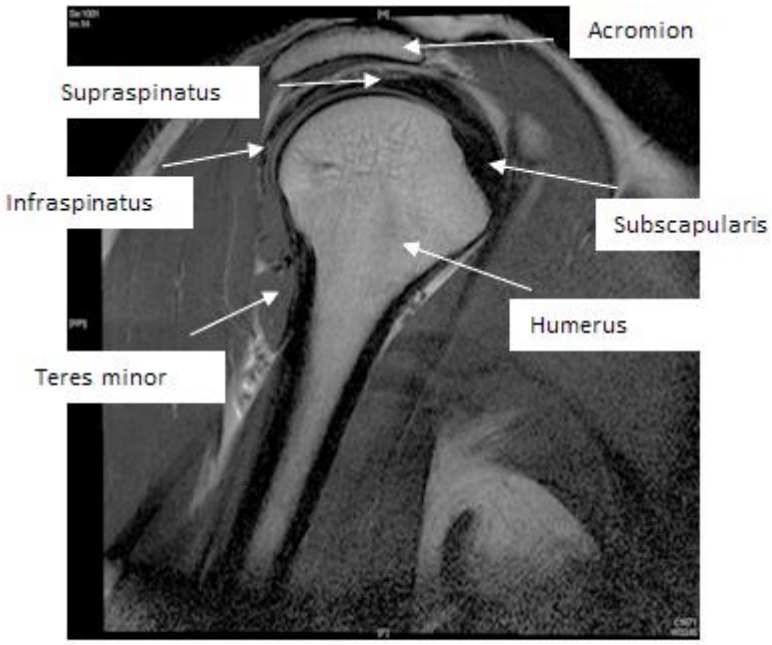

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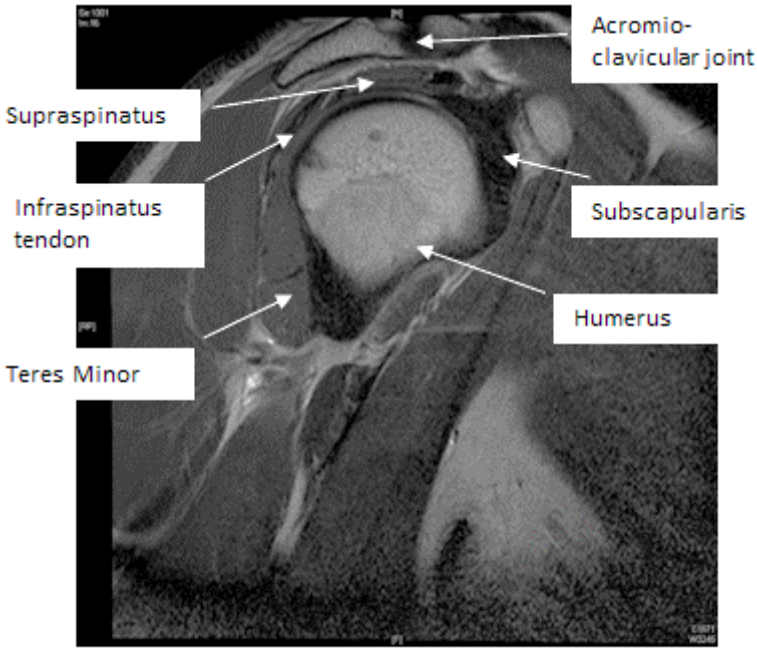

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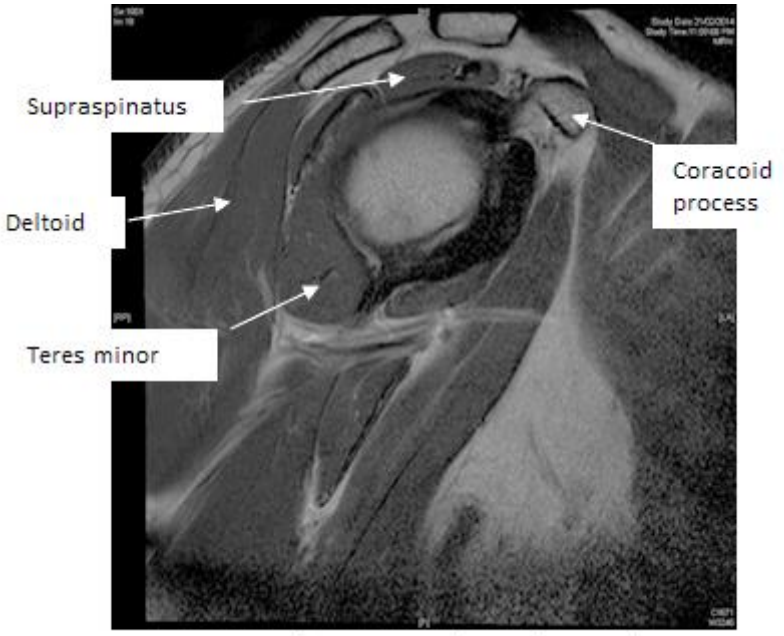
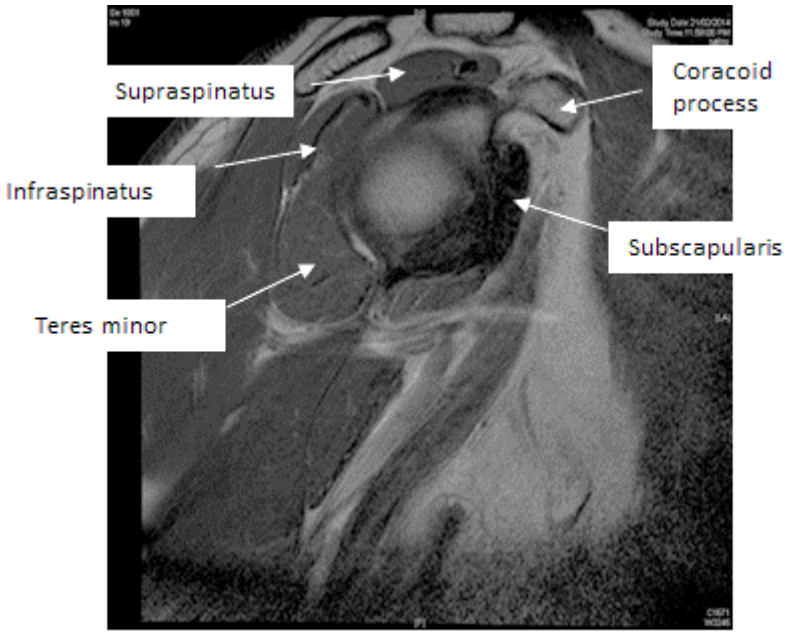


Proton density image (sagittal section)



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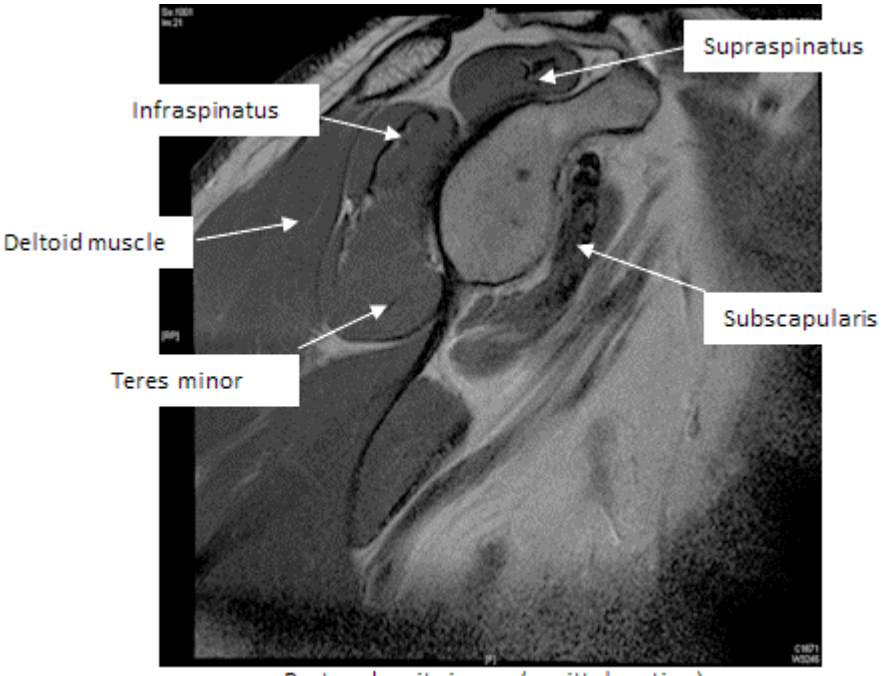

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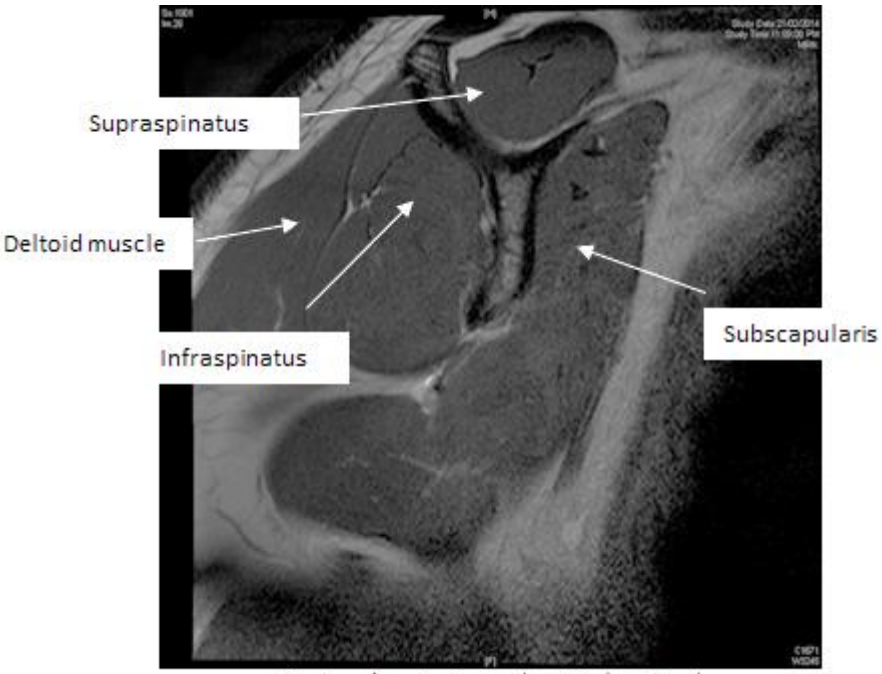
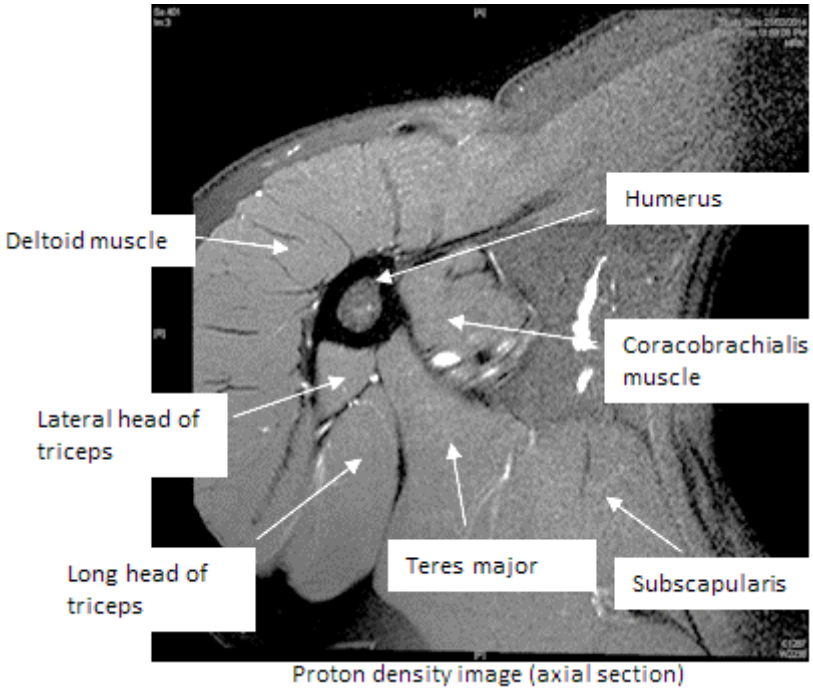


Proton density image (sagittal section)

Proton Density (Axial sections)



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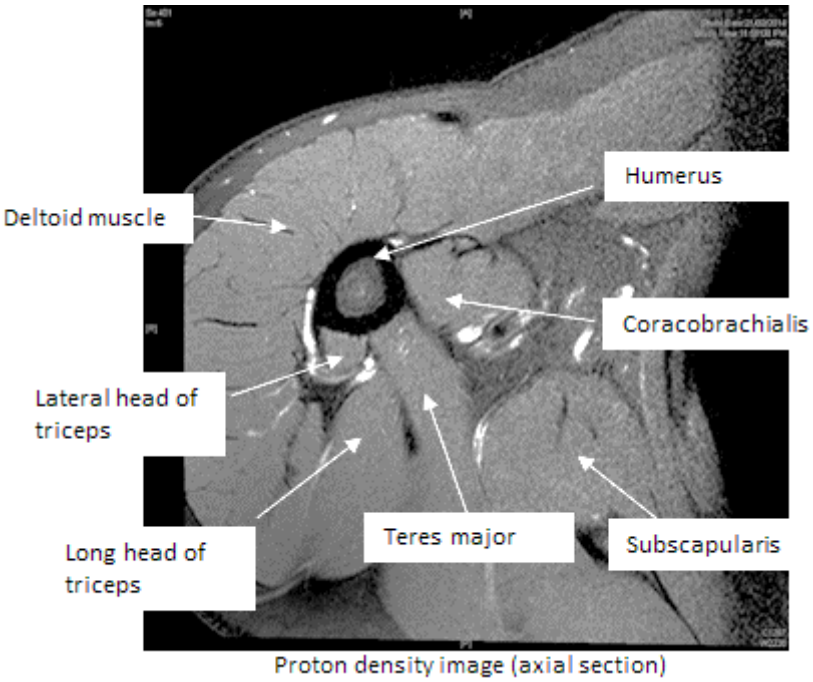

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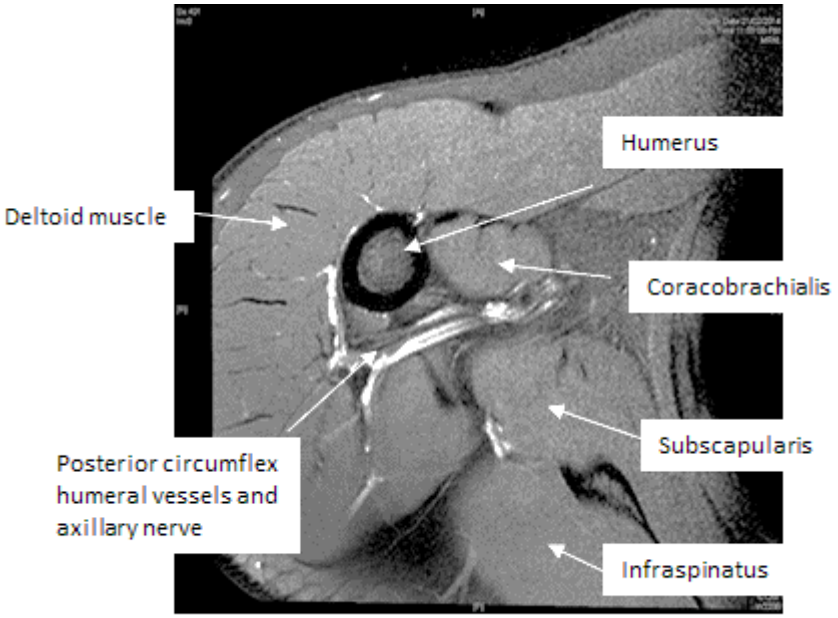

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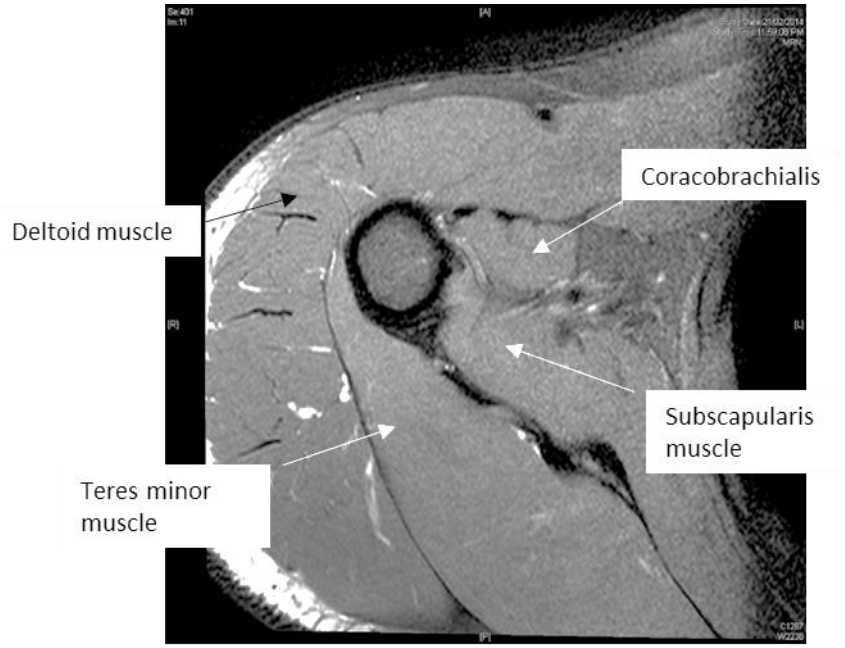

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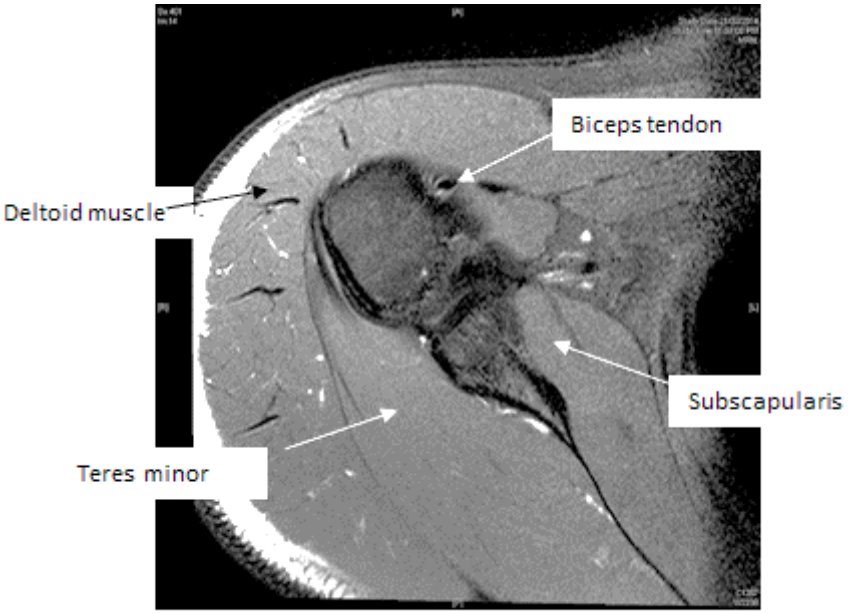

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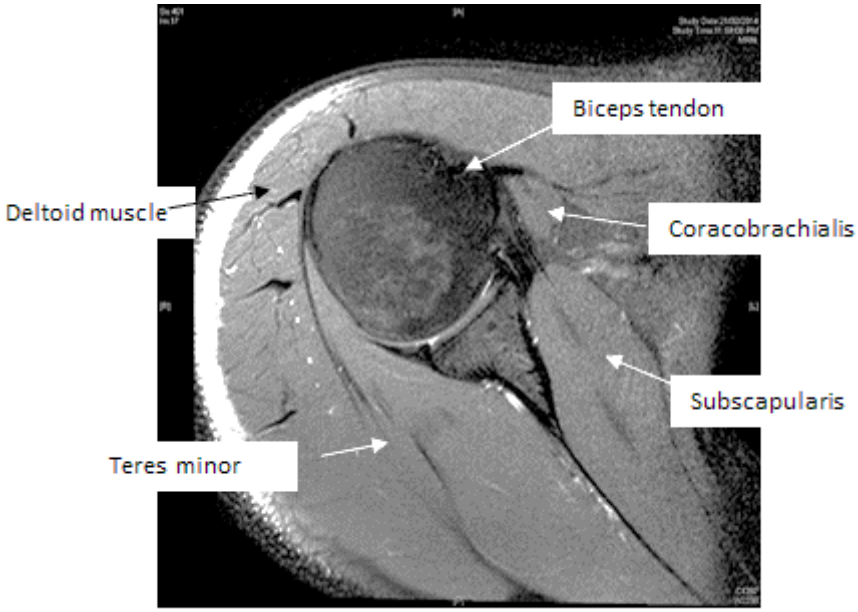

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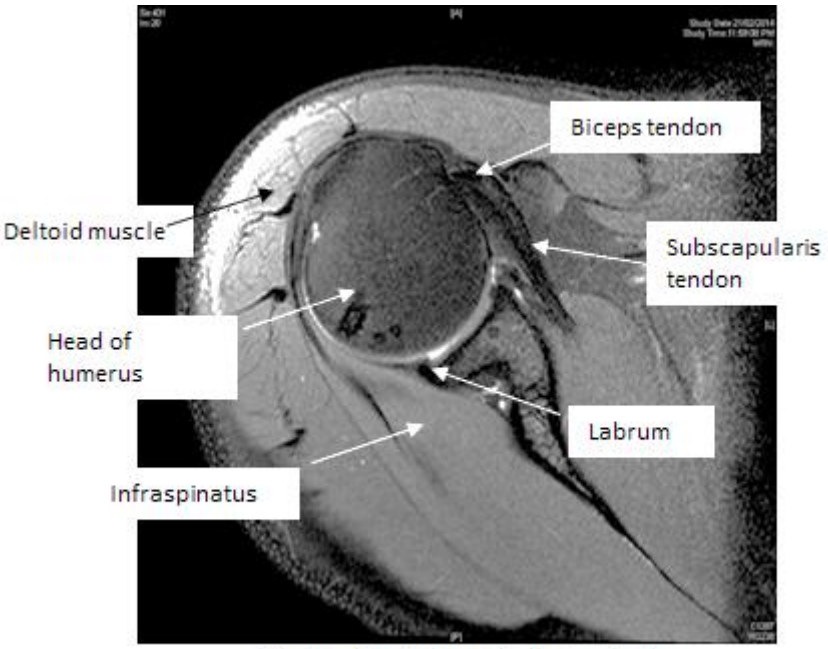

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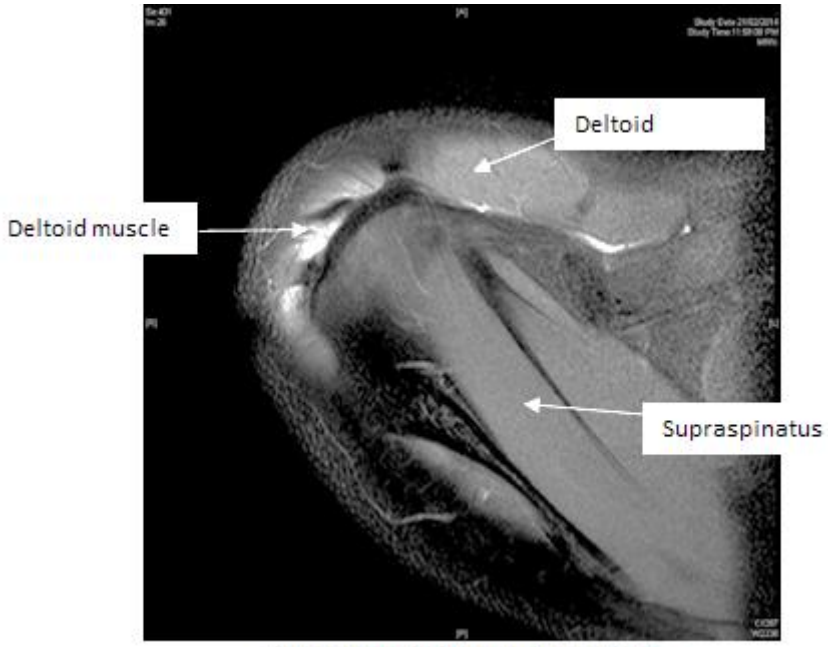

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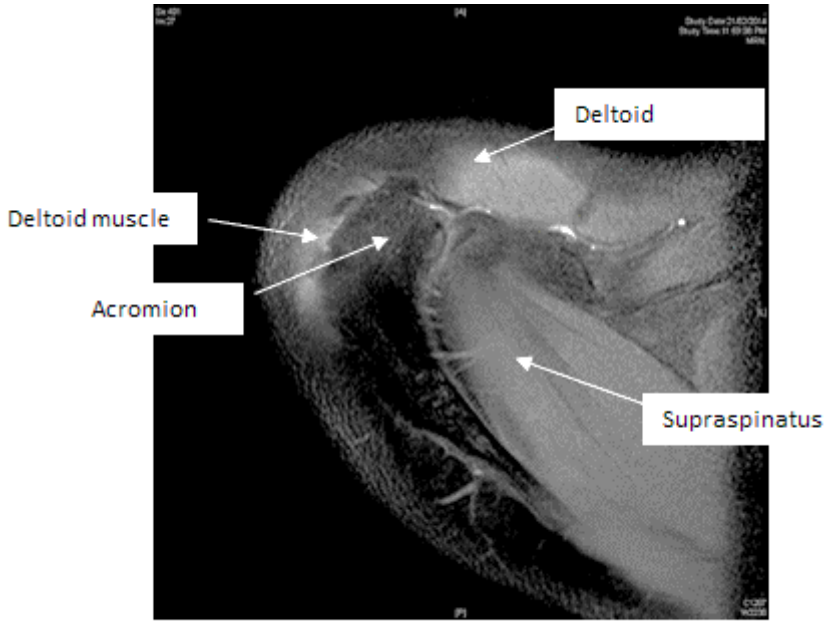
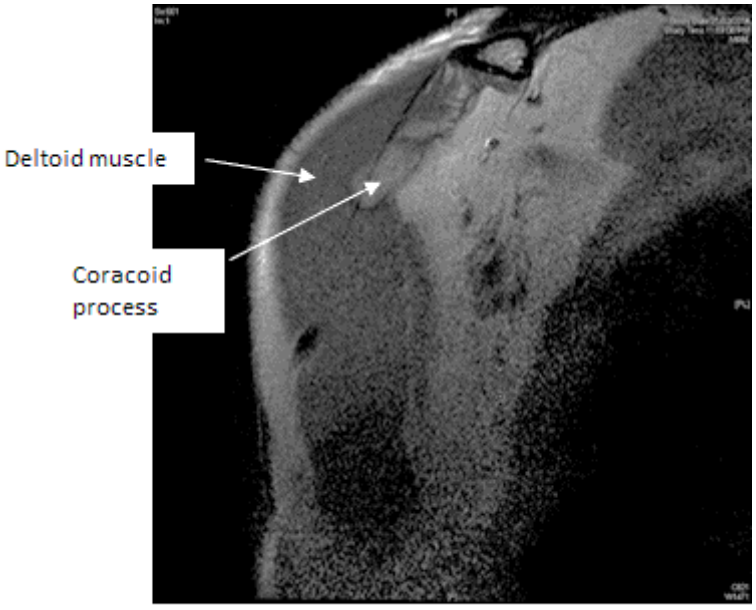
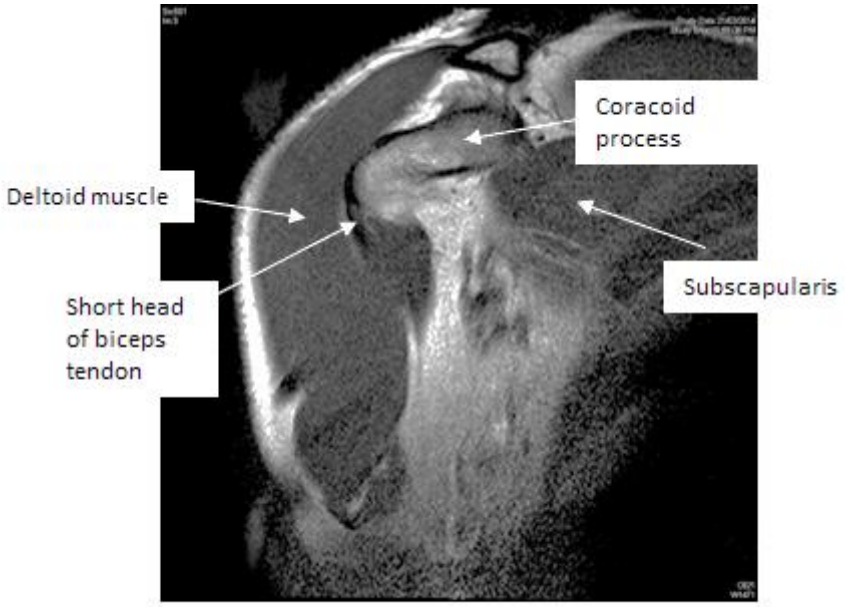


Proton density image (axial section)

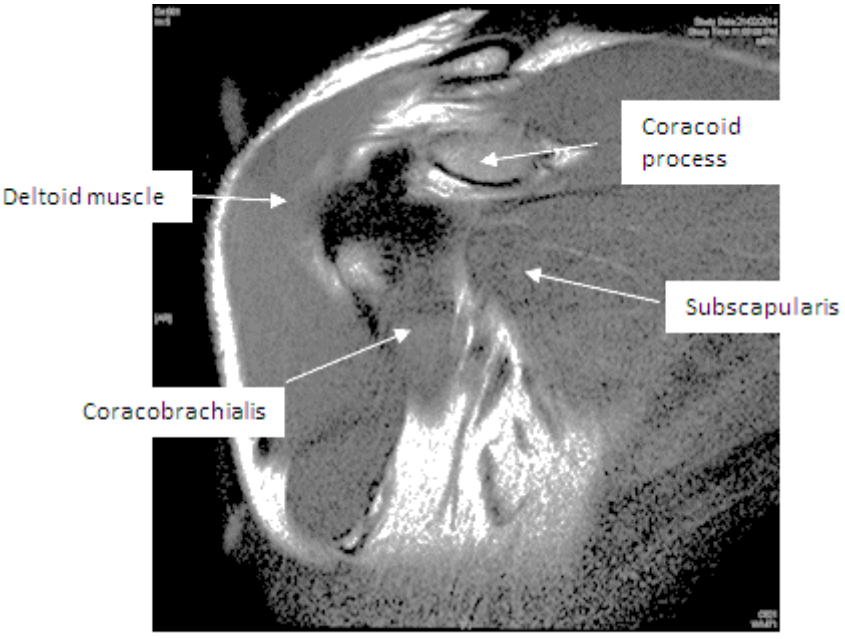
Proton Density (coronal sections)



Proton density image (coronal section)



Proton density image (coronal section)



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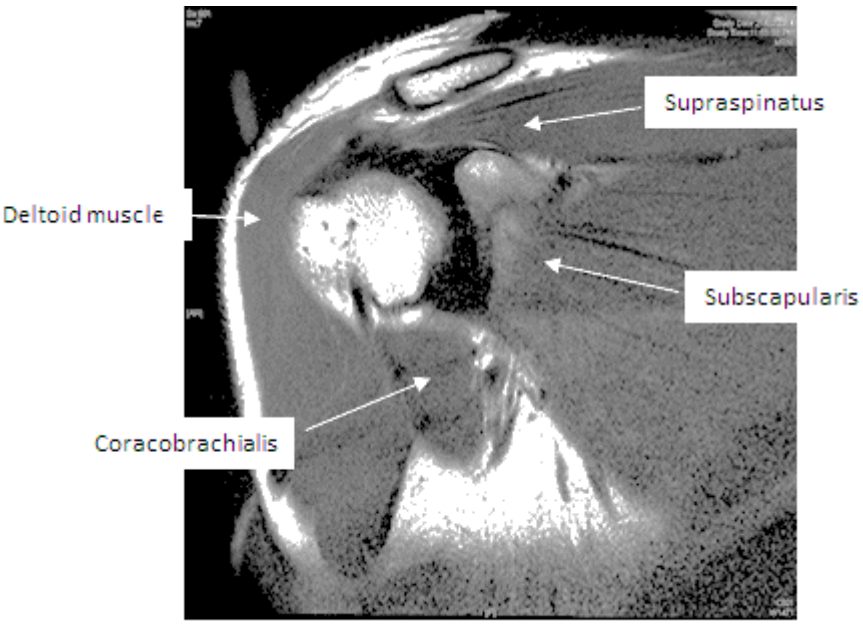

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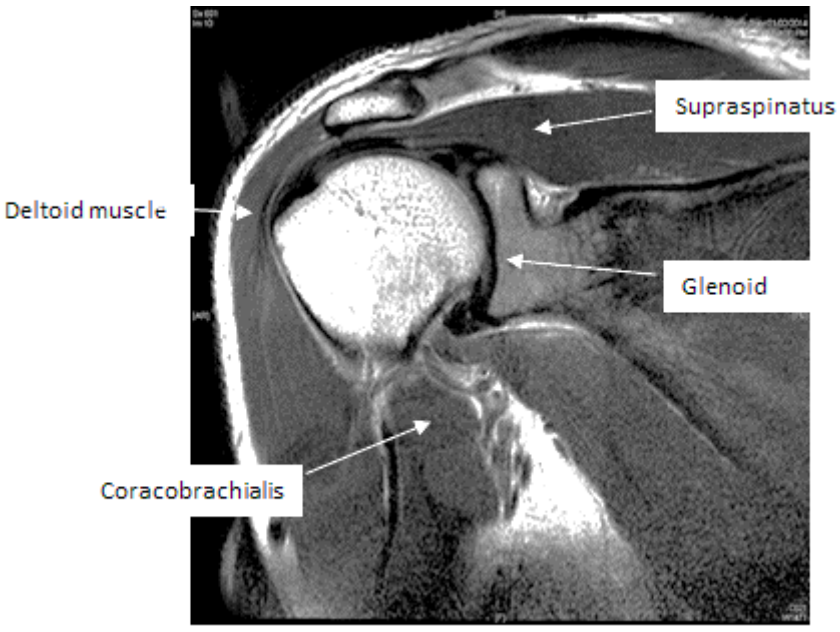

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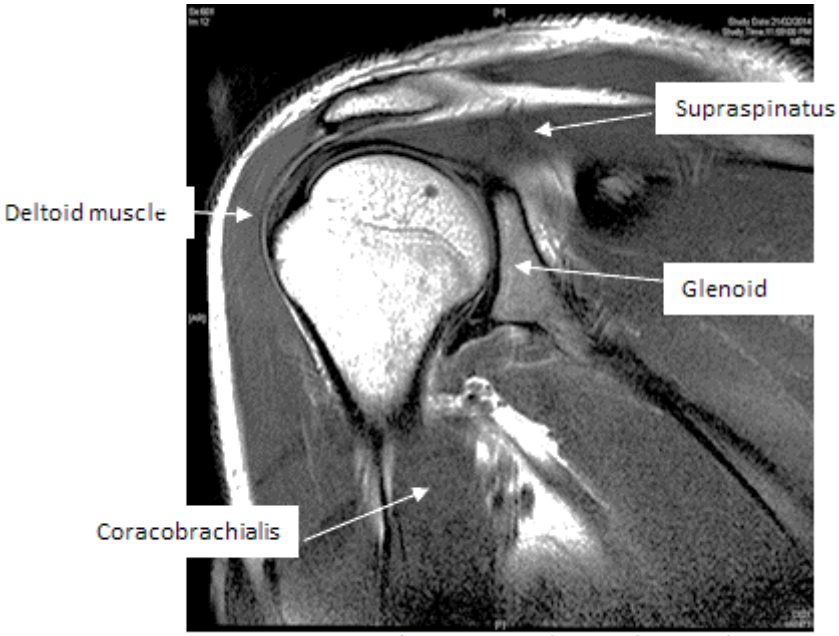

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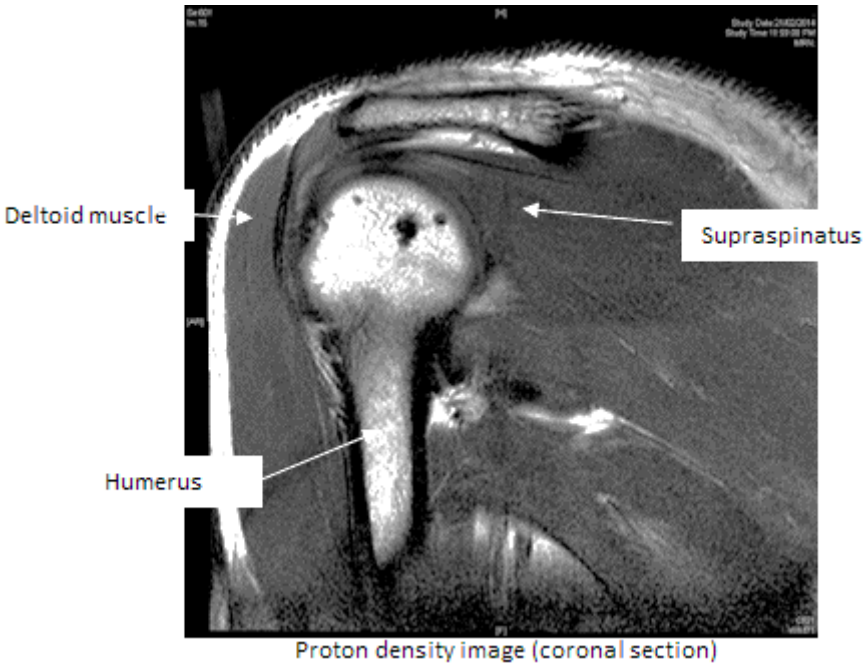

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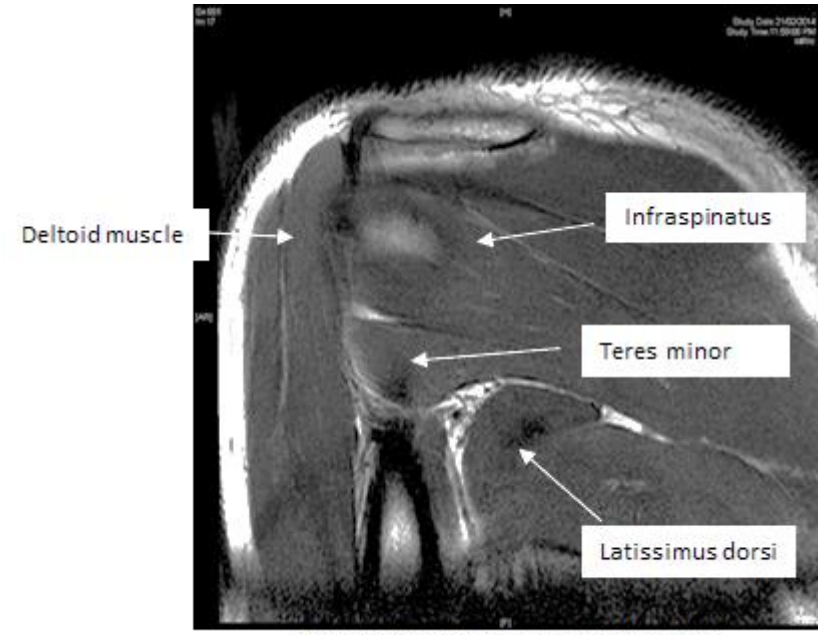

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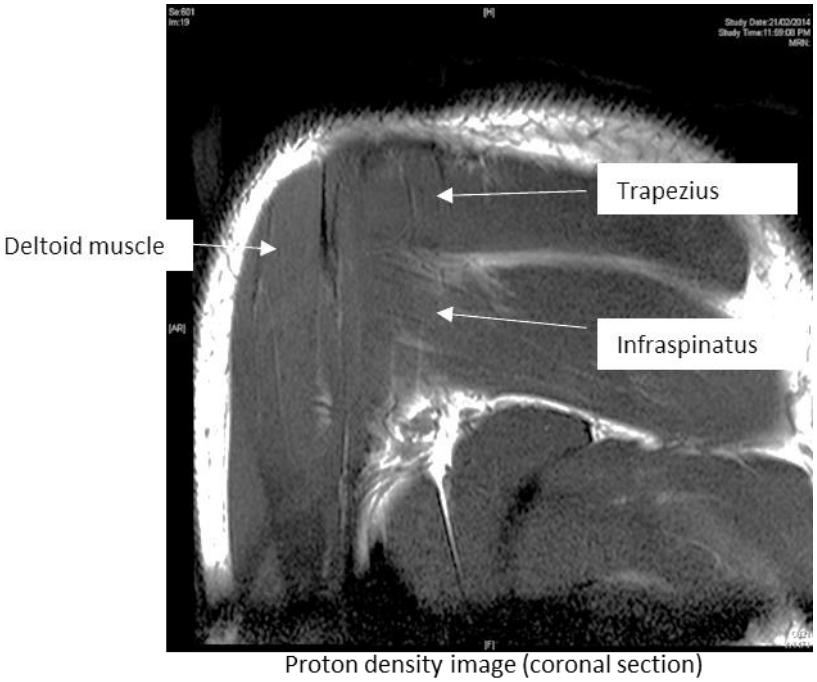

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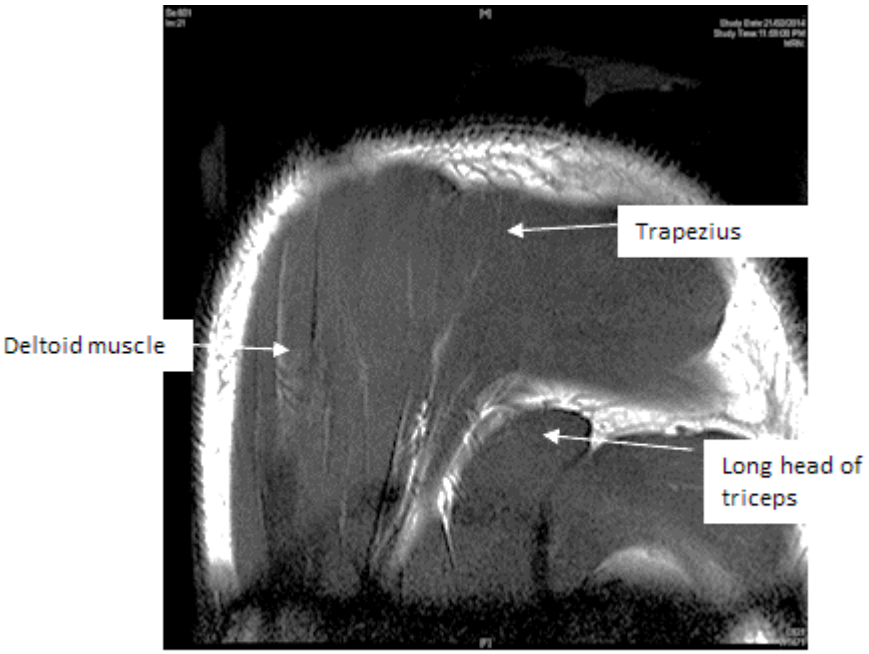
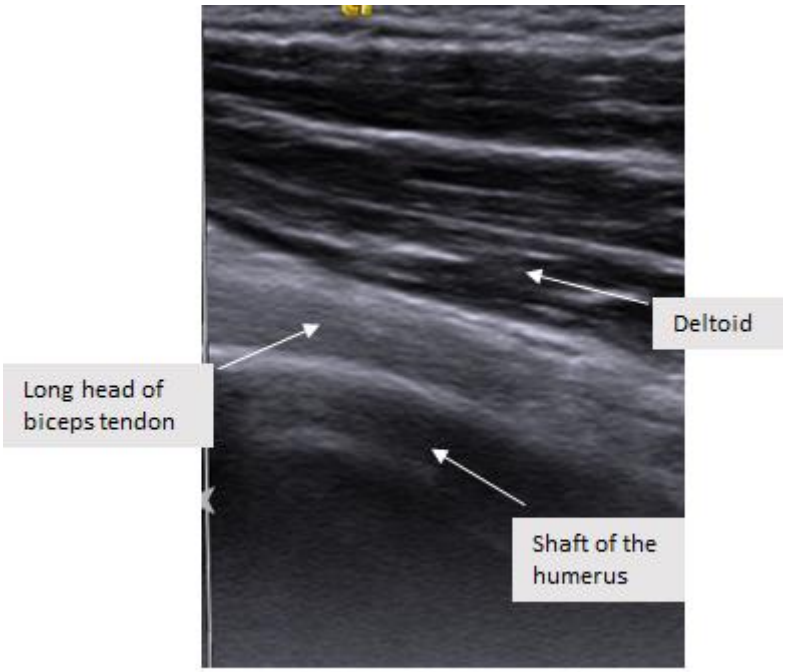
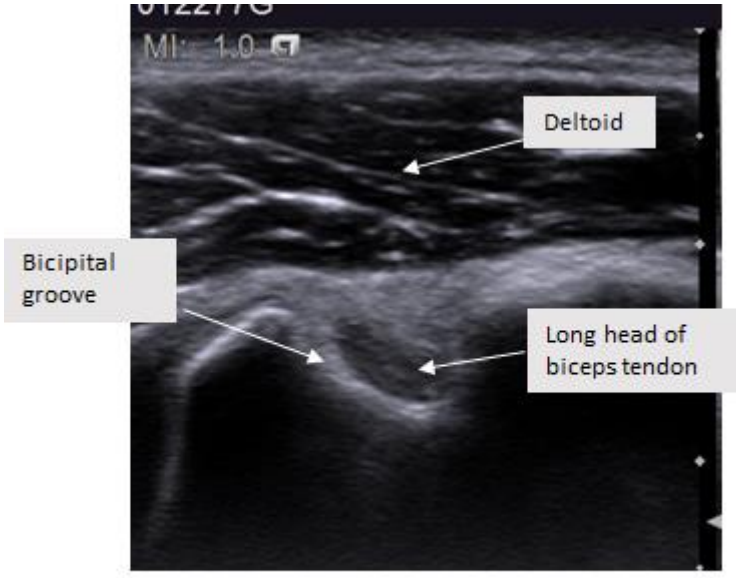


Proton density image (coronal section)

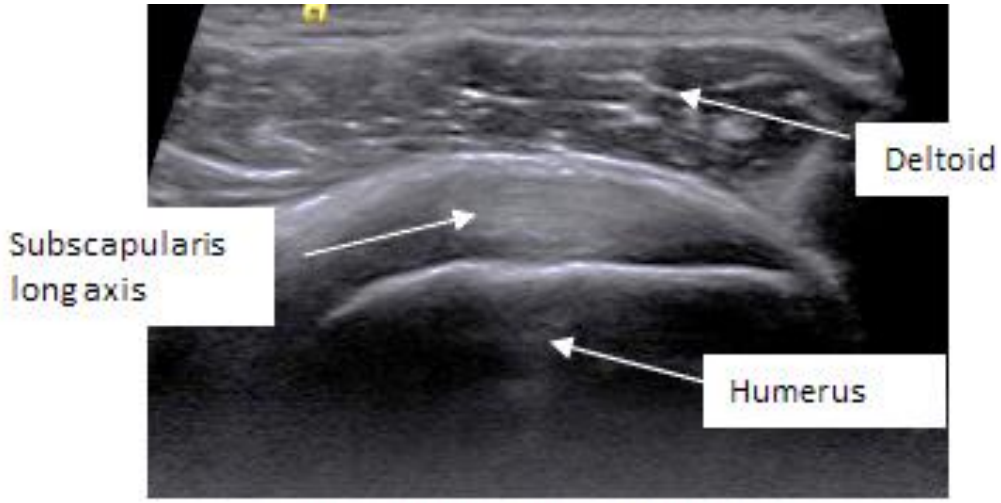
Normal Ultrasound Anatomy of Shoulder:



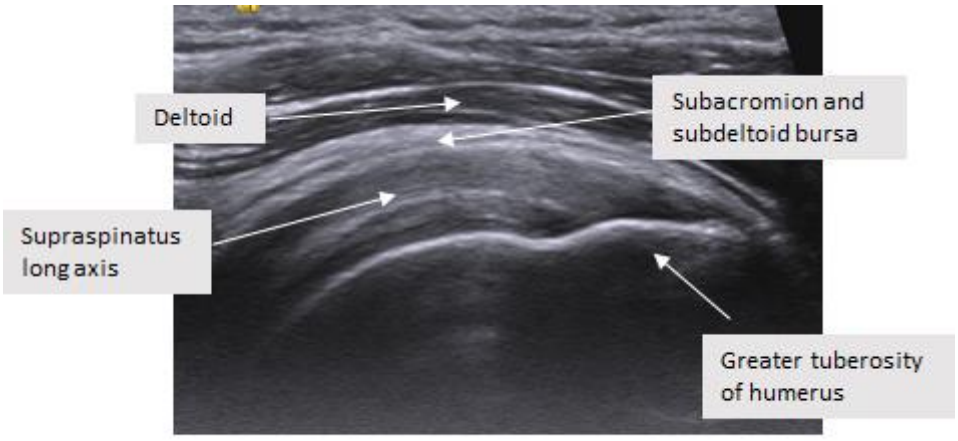
Long head of biceps tendon (long axis)



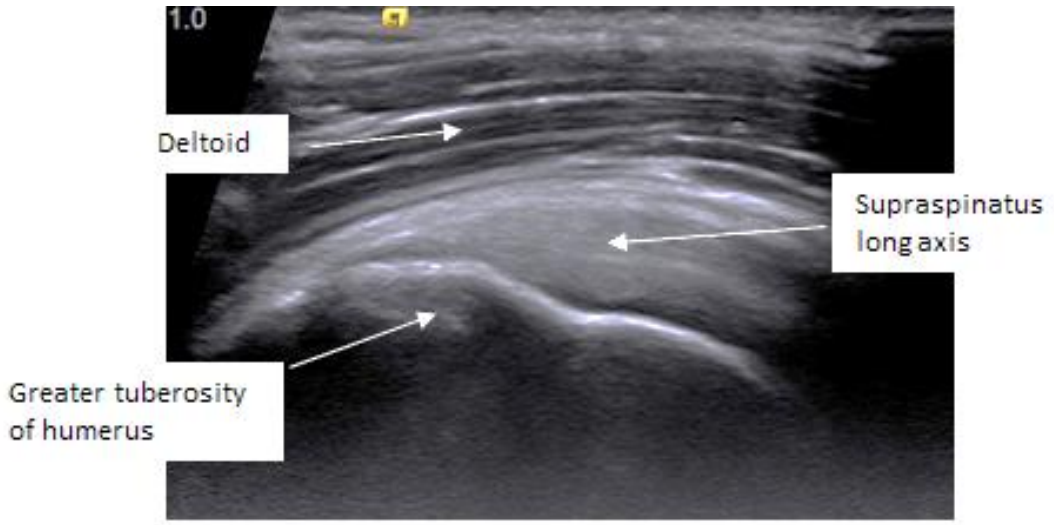
Long head of biceps tendon in the Bicipital groove (short axis)



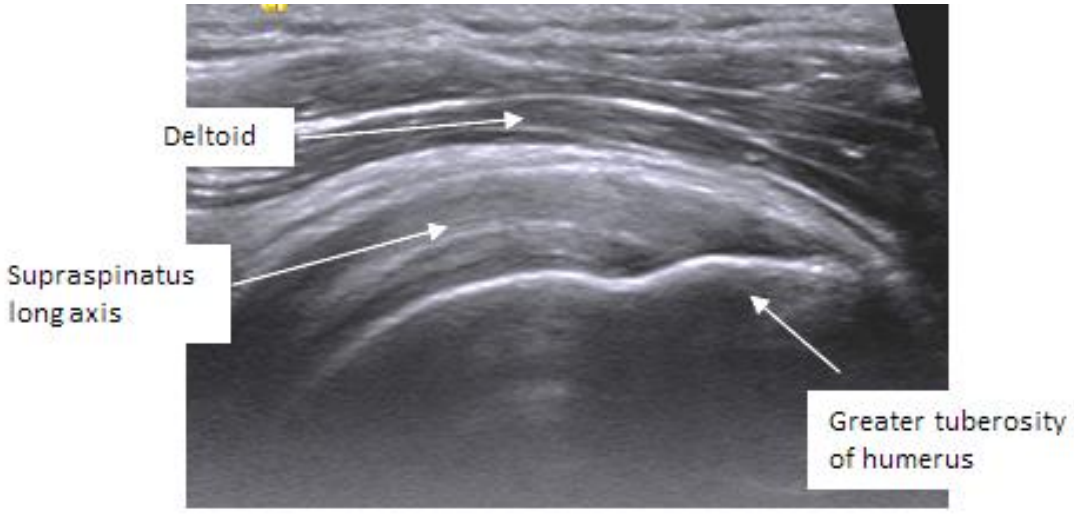
Subscapularis muscle (long axis)



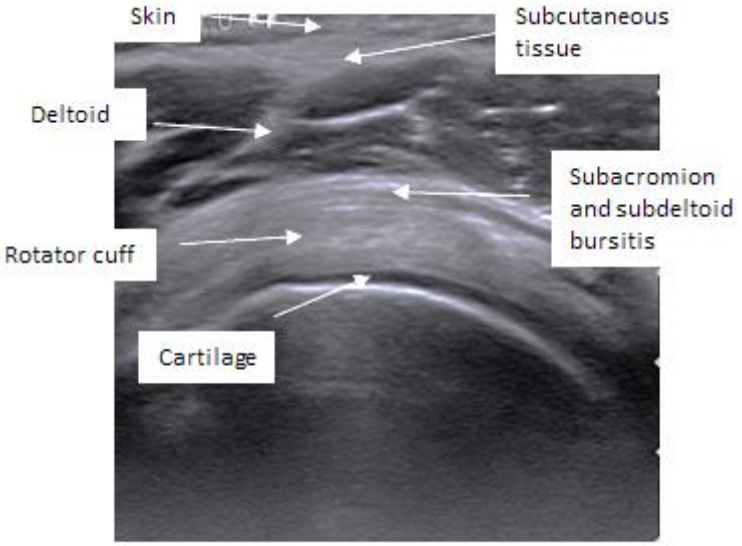
Supraspinatus (long axis)



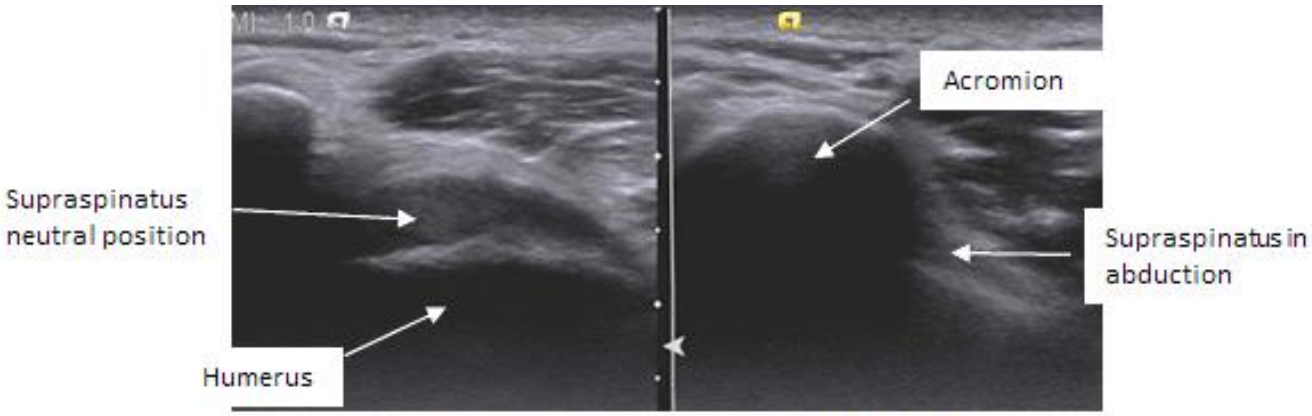
Supraspinatus (long axis)



Supraspinatus (long axis)



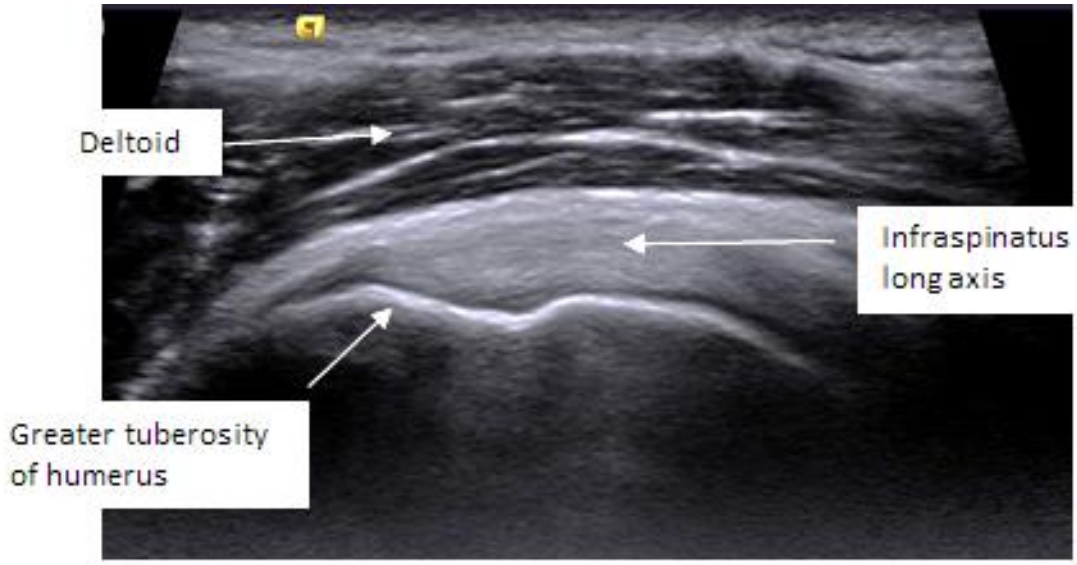
Layers seen on ultrasound



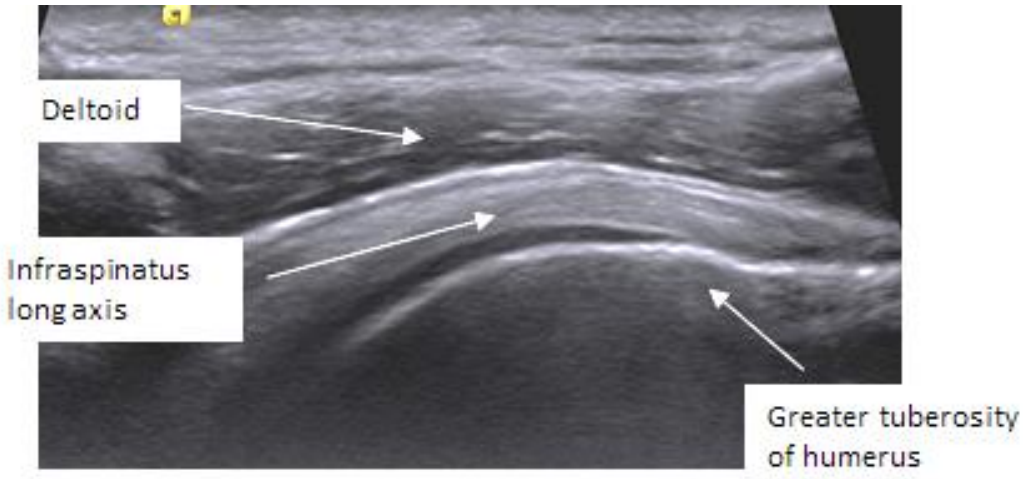
Supraspinatus in neural position

Supraspinatus in abduction position

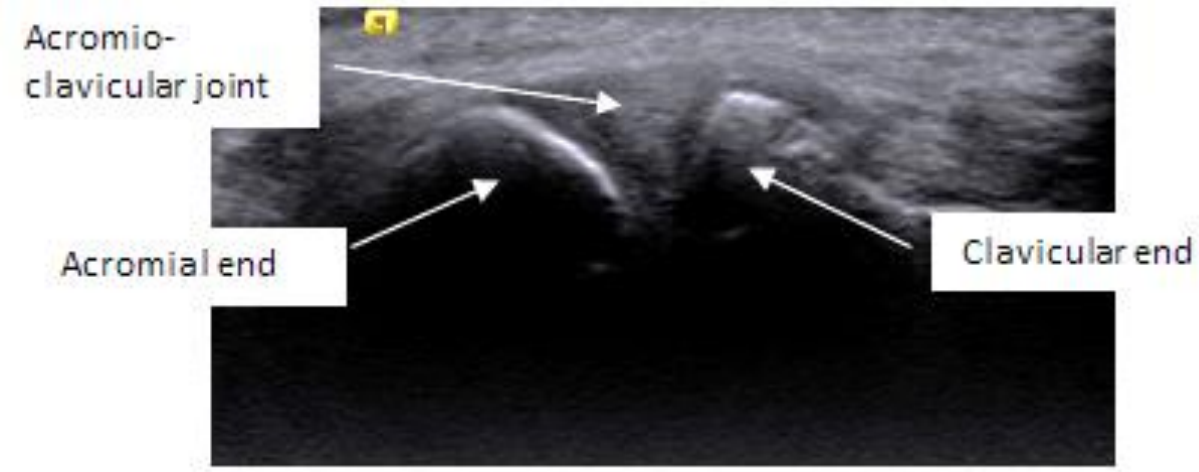
Dynamic shoulder movement



Infrapinatus (long axis)



Infraspinatus (long axis)



Acromio-clavicular joint

Evaluation of patients with rotator cuff pathology:

Pain is the most common symptom of rotator cuff pathologies. It most commonly localises to the anterior and lateral aspect of the shoulder when rotator cuff injury is present. However, it is a poor indicator of the exact site of injury in the rotator cuff. (21)

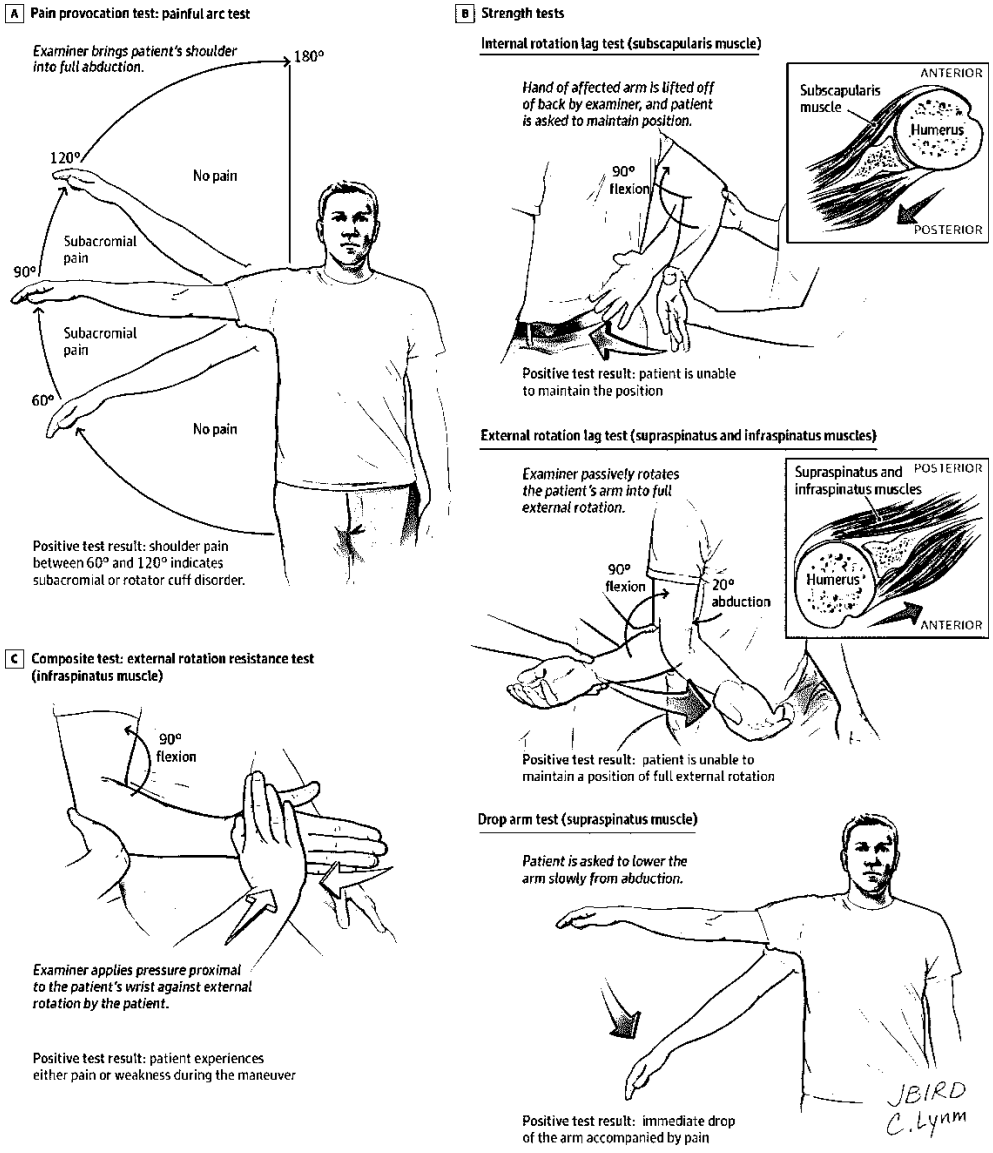


Figure 2. (20)

Recommended Clinical Tests for the Evaluation of Rotator Cuff Disease.

Clinical tests for the diagnosis of rotator cuff tears:

A systematic review is published by Hermans J, et al in which he assessed the diagnostic accuracy of different clinical examinations in the diagnosis of rotator cuff disease and tears. This is measured in terms of likelihood ratios (LR) for the presence of rotator cuff disease or tears. He found that positive external rotation lag test (LR of 7.2) and internal rotation lag test (LR of 5.6) were most accurate in the diagnosis of full thickness tears of rotator cuff. Positive painful arc test had a likelihood ratio of 3.7; while it was 3.3 for positive arm drop test. (20)

Clinical tests. (20)

	Positive clinical Test	**Involved muscle**
1.	External rotation lag test	Infraspinatus and supraspinatus
2.	Internal rotation lag test	Subscapularis
3.	Painful arc test	Impingement
4.	Arm drop test	Supraspinatus

Table 1:

Investigations:

The following investigations are available for evaluation of rotator cuff disease (22):

1. Radiography
2. Arthrography
3. Ultrasound
4. CT arthrography
5. MRI (magnetic resonance imaging)
6. MR arthrography (MRA)
7. Arthroscopy

Radiography:

Radiography is insensitive in the diagnosis of rotator cuff tears; however certain radiographic features may suggest presence of chronic rotator cuff tears. (23) This includes:

1. Acromiohumeral space less than 6 mm
2. Cranial migration of humeral head causing erosions on the inferior surface of acromion
3. Flattening of greater tubercle of humerus

Contrast arthrography:

Contrast arthrography is performed to exclude the diagnosis or rotator cuff tear. The subacromial and subdeltoid bursa does not communicate with the rotator cuff and presence of contrast in this bursa is suggestive of rotator cuff tear. (19) (23) However, due to its invasive nature and lack of soft tissue characterisation, contrast arthrography is used less often. (23)

CT arthrography:

CT arthrography is considered a sensitive tool for the diagnosis of rotator cuff tears. In one of the study done by Charousset C, et al who compared CT arthrography with arthroscopy showed excellent correlation between the two modalities. 259 shoulders were evaluated. The sensitivity and specificity of CT arthrography to diagnose supraspinatus tear was 99% and 100%, it was 97.44% and 99.52% for infraspinatus and 64.71% and 98.17% for subscapularis tears. (24) With the development of newer CT scanners there has been a significant improvement in the sensitivity of CT arthrography to diagnose rotator cuff tears. In one of the study done by Callaghan JJ, et al in 1988, the sensitivity of CT arthrography for diagnosis of rotator cuff tear for 50% only. (25) However, the drawback of CT arthrography is its invasive nature and radiation exposure.

Ultrasound, MRI and MR arthrography:

Ultrasound of the shoulder joint for the diagnosis of rotator cuff tears is been used for at least over the last three decades. One of the study done by Paavolainen P, et al in 1994 showed sensitivity and specificity of ultrasound for the diagnosis of rotator cuff tears to be 74% and 95% with respect to operative finding in 49 patients. (26) With the development of newer ultrasound machines the sensitivity of ultrasound to diagnose rotator cuff tears has improved. A meta-analysis published in 2011 by Smith TO, et al assessed the diagnostic accuracy of ultrasound in the diagnosis of rotator cuff tears. In this meta-analysis; 62 studies were included which had 6007 patients; and 6066 shoulders were analysed. Ultrasound showed 84%

sensitivity and 89% specificity in the diagnosis of partial thickness tears, while it was 96% sensitive and 93% specific for the diagnosis of full thickness tear. (27)

In a Cochrane review (28) published in 2013 by Lenza M, et al, the diagnostic strength of ultrasound, MRI and MR arthrography was assessed for the diagnosis of rotator cuff tears among patients planned for surgery. The sensitivity and specificity of ultrasound was found to be 91% and 85% respectively for any rotator cuff tears among 626 cases (854 shoulders). It was 92% and 93% respectively for full thickness tears of rotator cuff in 386 cases (739 shoulders) and it was 52% and 93% respectively for partial thickness tears respectively in 121 cases (660 shoulder).

The sensitivity and specificity of MRI for the diagnosis of rotator cuff tears was found to be 98% and 79% respectively in 263 cases (347 shoulders). It was 94 % and 93% respectively for full thickness tears in 193 cases (368 cases); while it was 74% and 93% respectively for partial thickness tears. Meta-analysis of MR arthrography (MRA) studies was not done; however the sensitivity of MRA ranged from 72% to 100% in different studies. The review concluded that USG, MRI and MRA have similar diagnostic accuracy for the diagnosis of rotator cuff tears and may be performed similarly.

Studies from India to assess the diagnostic accuracy of USG, MRI or MRA for the diagnosis of rotator cuff tears among Indian population are lacking.

Methodology:

1. The study protocol was approved by the Institutional Review Board (IRB), CMC, Vellore.
2. Ultrasound of the shoulder was done free of cost for the patients planned for MRI scan of the same shoulder joint.
3. **Study population recruitment.**
    a. **Inclusion criteria:**
        i. Shoulder pain, both acute and chronic
        ii. Stiffness of shoulder
        iii. Restriction in activities of daily living
        iv. Trauma to shoulder
    b. **Exclusion criteria:**
        i. Refusal for the ultrasound study
        ii. Female subjects without a chaperone
        iii. Post-operative cases
        iv. Subjects unable to cooperate due to pain
        v. Patients presenting for evaluation of tumours / malignancies
4. **Design of data collection.**
    a. Demographic data and questions related to risk factors were collected prospectively
    b. Available online lab investigations were checked retrospectively
5. **Reference standard.** MRI for all the subjects
6. **Index or experimental test.** NA.

7. **Personnel.**

    a. **Ultrasound operator:**

        i. PG resident doing the thesis

    b. **MRI reporting doctor:**

        i. Musculoskeletal radiologist

8. **Equipment:**

    a. Ultrasound machine:

Siemens ACUSON S2000

14 MHz ultrasound transducer used for the study

b. MRI scanner:

Philips Achieva 3.0T MRI

9. **Timing.** Efforts were made to do both the tests on the same day.

10. Minimizing bias. The index test (ultrasound) were interpreted independently of the reference standard (MRI)

11. Study protocol:

a. MRI of the shoulder: The following sequences were acquired:

i. Proton density weighted (PDW) axial SPAIR (fat suppressed)

ii. T2W SPAIR coronal

iii. T2W SPAIR sagittal

iv. PDW coronal

v. PDW sagittal

vi. T1W axial

Ultrasound of the shoulder:

- Subjects were made to sit on a rotating chair and the study was explained
- Subjects were made to perform the routine manoeuvre like external and internal rotation of arm, abduction of arm and extreme internal rotation of arm such that the dorsum of hand touches the back of the patient needs to perform shoulder ultrasound
- Sequence of assessment:
    - First biceps tendon was assessed with elbow at 90 degree flexion. Subject was made to internally and externally rotate the arm to rule out dislocation of tendon from the bicipital groove
    - Subscapularis was assessed with the arm in external rotation and elbow at 90 degree flexion
    - Acromio-clavicular joint was assessed for arthritis
    - Abduction of arm done to assess for impingement
    - Supraspinatus and infraspinatus assessed after keeping the arm in internal rotation such that the dorsal of the hand touched the back of the subject

Ultrasound criteria for rotator cuff pathology (29):

Tendinosis:

Characterised by a heterogeneous, ill defined, hypoechoic area in the tendon with variable change in the calibre (enlarged / thinned) without a tendon defect

Partial thickness tendon tear:

Characterised by a well-defined hypoechoic or anechoic abnormality that disrupt the tendon fibres

Interstitial tear: does not extend to bursal or articular surface

Articular tear: extends to articular surface

Bursal tear: extends to bursal surface

Full thickness tear:

Characterised by a well-defined hypoechoic or anechoic abnormality that disrupts the hyperechoic tendon fibres and extend from the articular to bursal surface of the tendon.

Ultrasound features of tendon tear and tendinosis:

Sr. No.	Tear	Tendinosis
1	Anechoic / hypoechoic	Hypoechoic
2	Relatively well defined	Ill defined
3	Homogenous	Heterogeneous
4	Thin	Swollen

Subacromial and subdeltoid bursitis:

- Normally 1-2 mm of hypoechoic layer of synovial fluid surrounded by hyperechoic bursal wall and peribrusal fat layer.
- Any increase in the amount of bursal fluid and / or synovial thickening / echoic in the bursal fluid considered abnormal.

Acromio-clavicular arthritis:

- Capsular distension (more than 3 mm), bone irregularity, osteophyte formation, joint space narrowing

Sample size calculation:

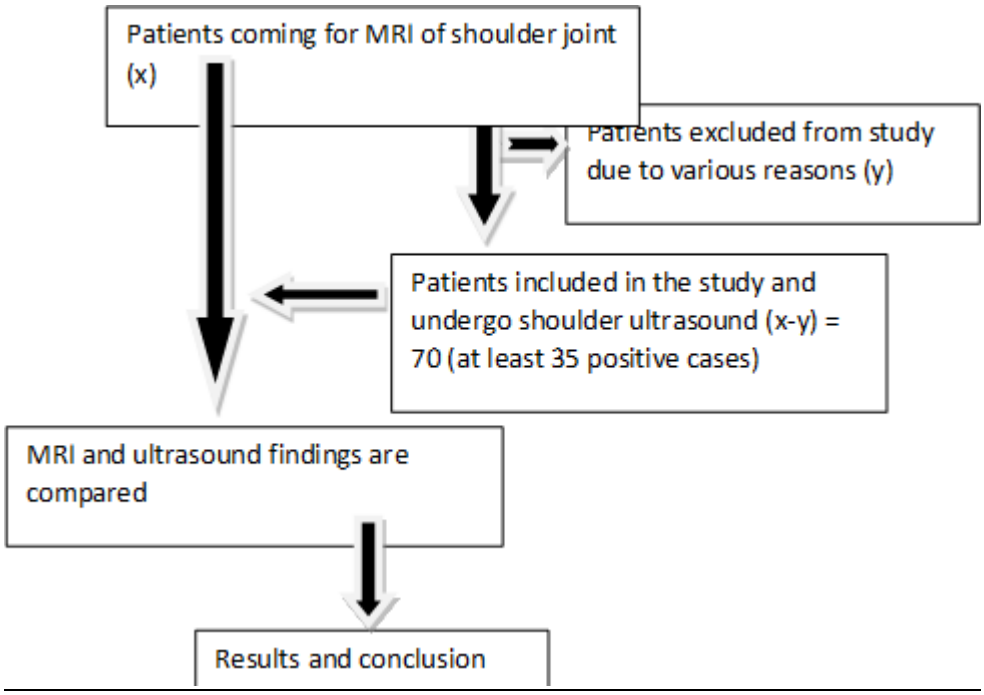
Sample size for new diagnostic tool:

- Expected specificity of new test 80%
- Precision of 10%
- Alpha error 5% (confidence interval of 95%)
- Minimum sample ~ 35 (positive cases)

Software used for sample size calculation: nMaster 2.0

Note: Specificity taken as 80% based on the study done by Iannotti et al which showed that ultrasound has as specificity of 80% to diagnose any rotator cuff tear.(30)

Diagrammatic Algorithm of the study:



Results:

Total Number of subjects (n): 70

Gender:

- Men: 55
- Women: 15

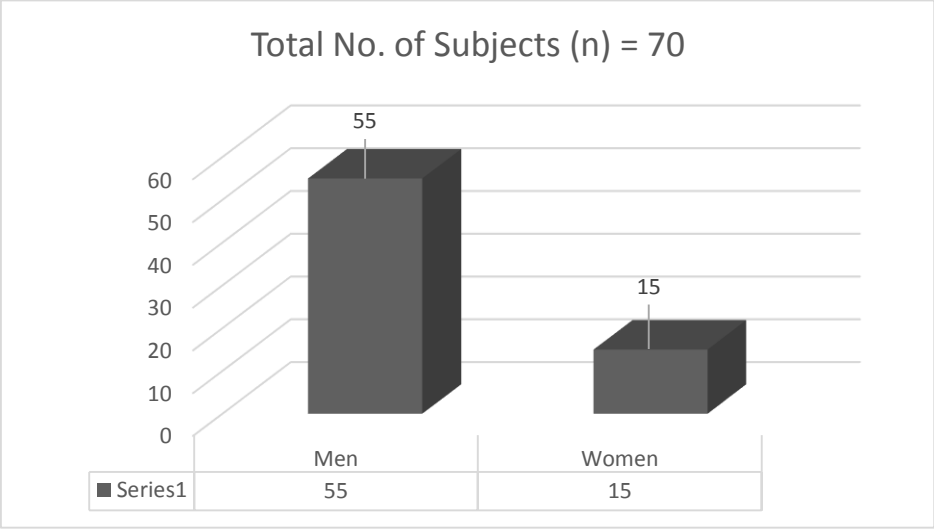


Figure 3:

Age:

- Average age of the subjects was 39.6 years (+/- 12.6 years)
- Average age for men was 38.3 years (+/- 12.6 years)
- Average age for women was 44.4 years (+/- 12 years)

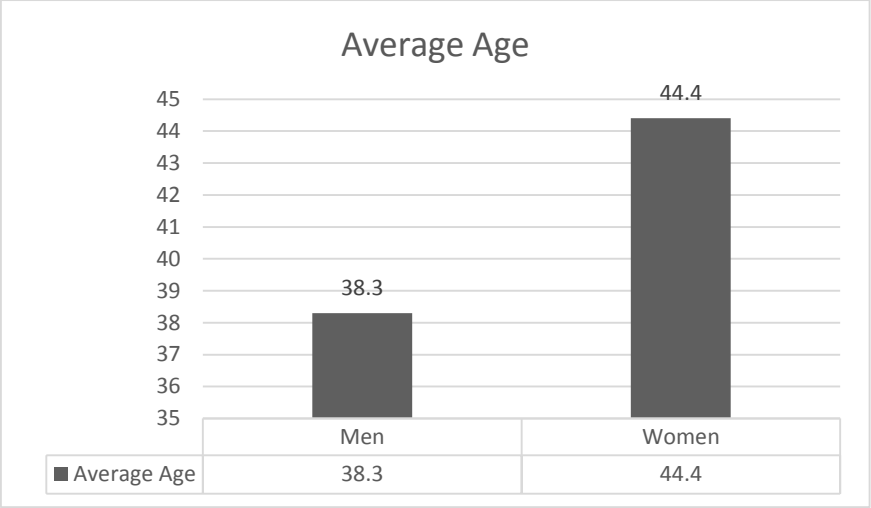


Figure 4:

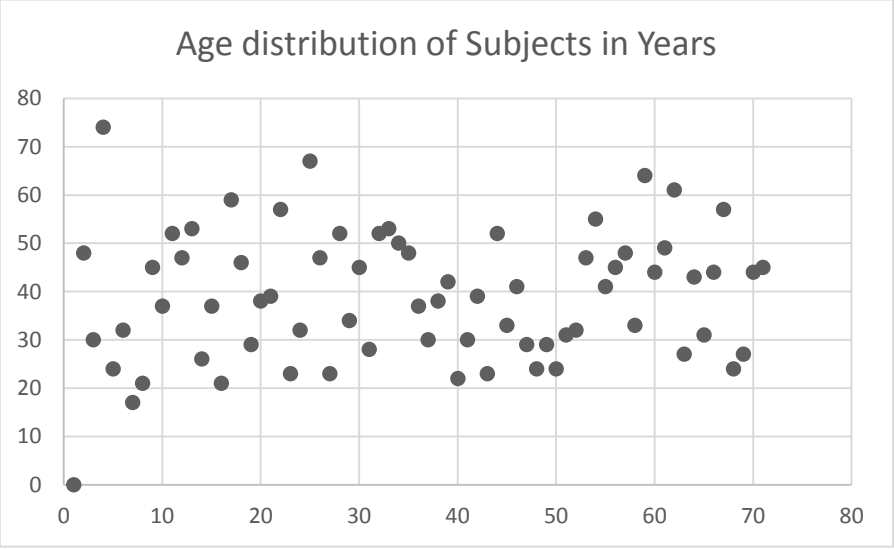


Figure 5:

Handedness:

- Data available for 46 subjects
- 45 were right handed
- 1 was left handed

Shoulder Evaluated:

- Right shoulder was evaluated in 45 subjects
- Left shoulder was evaluated in 25 subjects

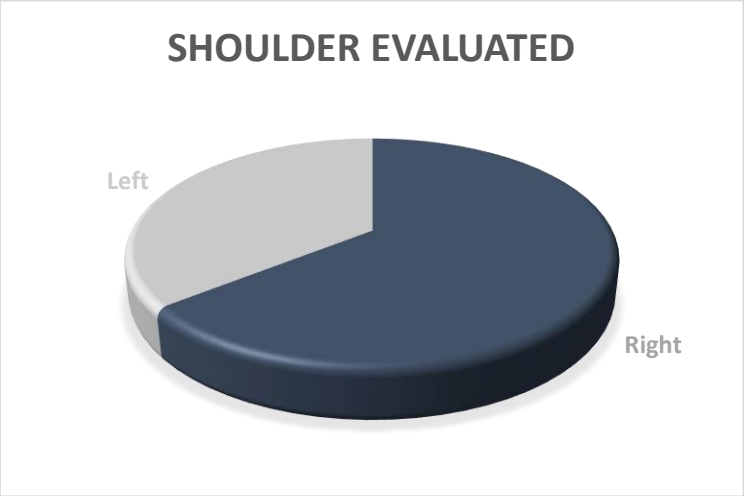


Figure 6:

Occupation:

- Occupation was divided into light (office / home) work or heavy (manual labour) work
- Data available for 50 subjects:
- 40 subjects did light work
- 10 subjects did heavy work

Figure 7:

Smoking:

- Data available for 40 subjects
- 15 subjects gave history of smoking
- 25 subjects did not give any smoking history

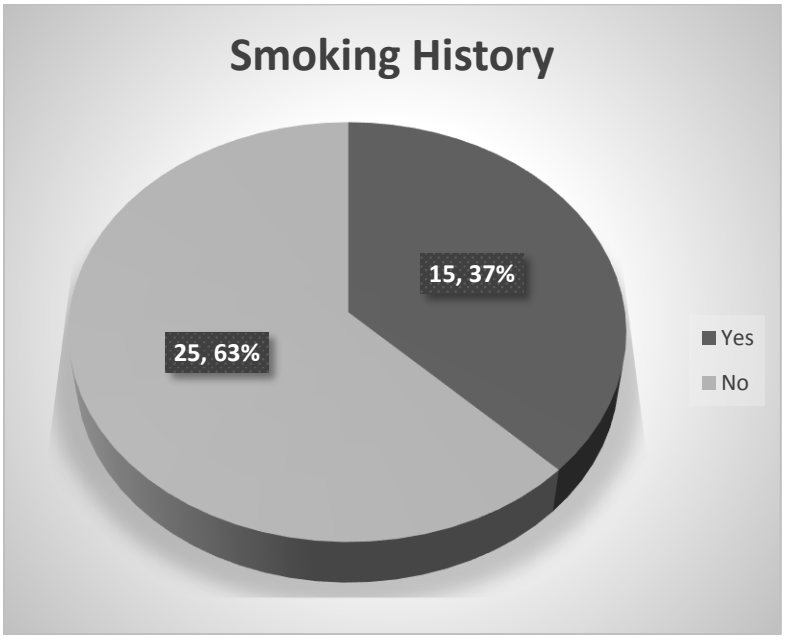


Figure 8:

History of Trauma:

- Data available for all 64 subjects
- 32 subjects gave past history of trauma, while the rest 32 subjects did not give any history of trauma

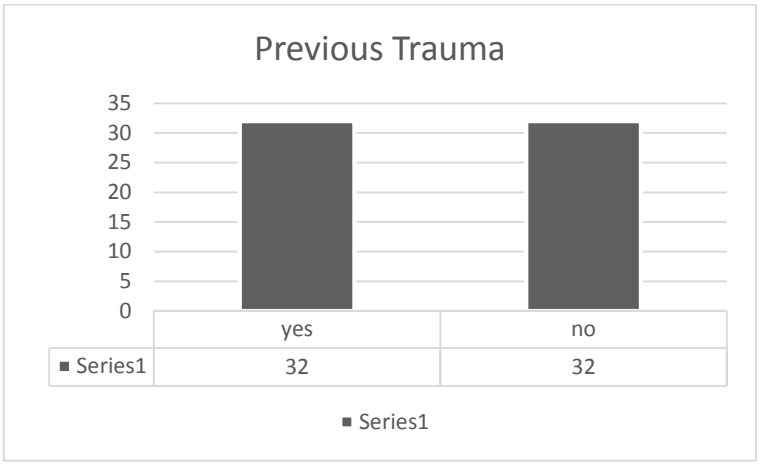


Figure 9:

Diabetes:

- Data available for 63 subjects
- 6 subjects had diabetes
- 57 subjects did not have diabetes

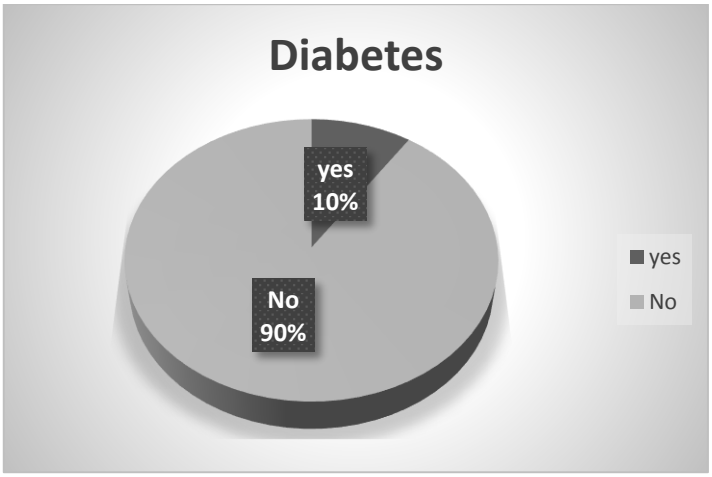


Figure 10:

Hypertension:

- Data available for 54 subjects
- 8 subjects were diagnosed case of hypertension
- 46 subjects did not have any history of hypertension

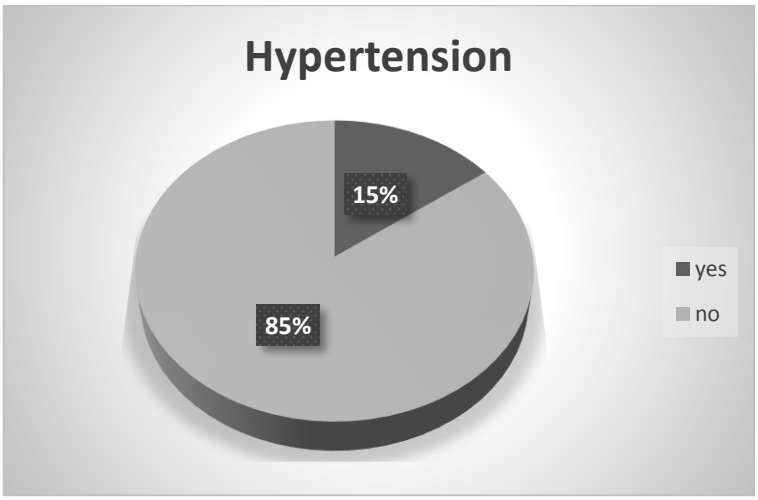


Figure 11:

Serum Cholesterol:

- Data available for 66 subjects
- Serum cholesterol value was checked in 19 subjects
- In 47 subjects, serum cholesterol was not assessed

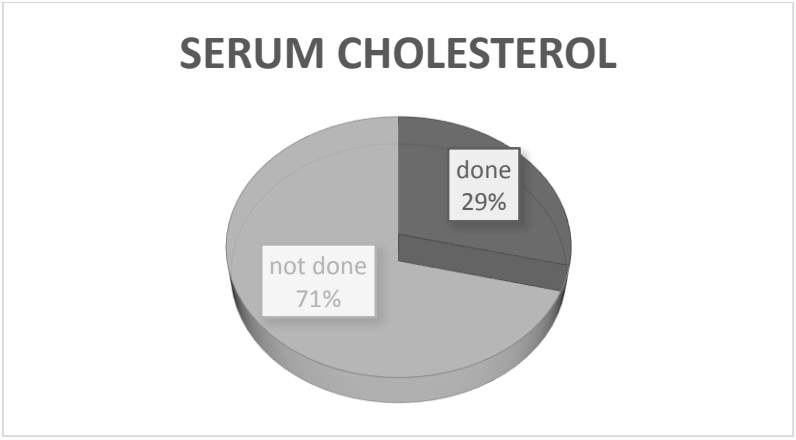


Figure 12:

Cholesterol Values:

Sr. No.	Total Cholesterol	Triglycerides	LDL	HDL
1	210	273	133	33
2	268	213	190	36
3	153	70	95	41
4	143	136	99	28
5	167	84	124	36
6	170	163	121	30
7	164	203	102	38
8	158	146	112	37
9	136	108	93	27
10	170	177	118	32
11	113	84	72	36
12	200	355	124	28
13	163	117	129	23
15	161	83	118	35
16	187	220	116	36
17	163	90	121	33
18	199	260	123	41
19	139	76	88	47
20	104	188	72	26

Table 2:

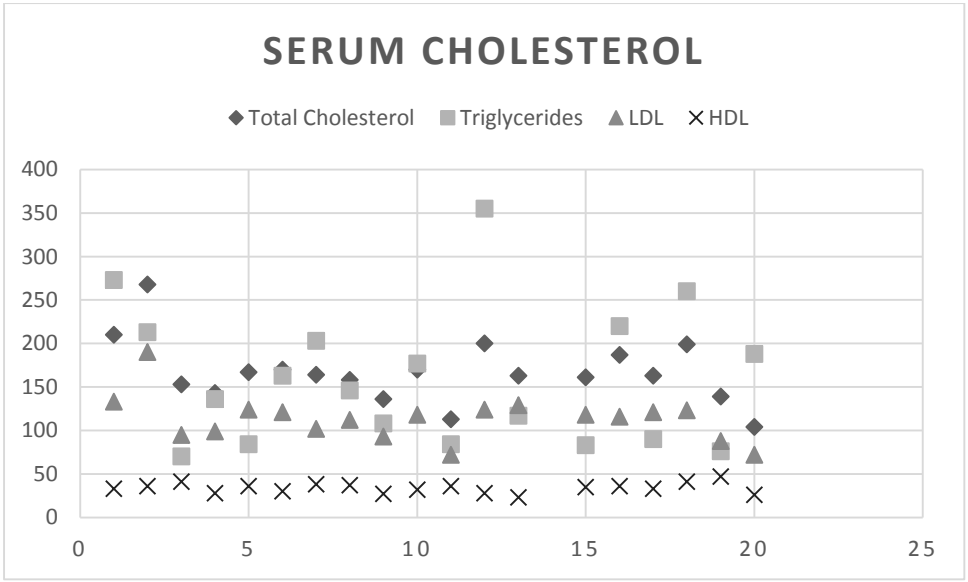


Figure 13:

Serum Vitamin D levels:

- Data available for 69 subjects
- Serum vitamin D was assessed in 18 subjects
- 51 subjects did not have their serum vitamin levels assessed
- Average serum vitamin D levels were 23.1 +/- 11.5 (normal >/= 30)
- Of the 18 subjects, 3 subjects had normal vitamin D levels; while the remaining 15 subjects had low serum vitamin D levels

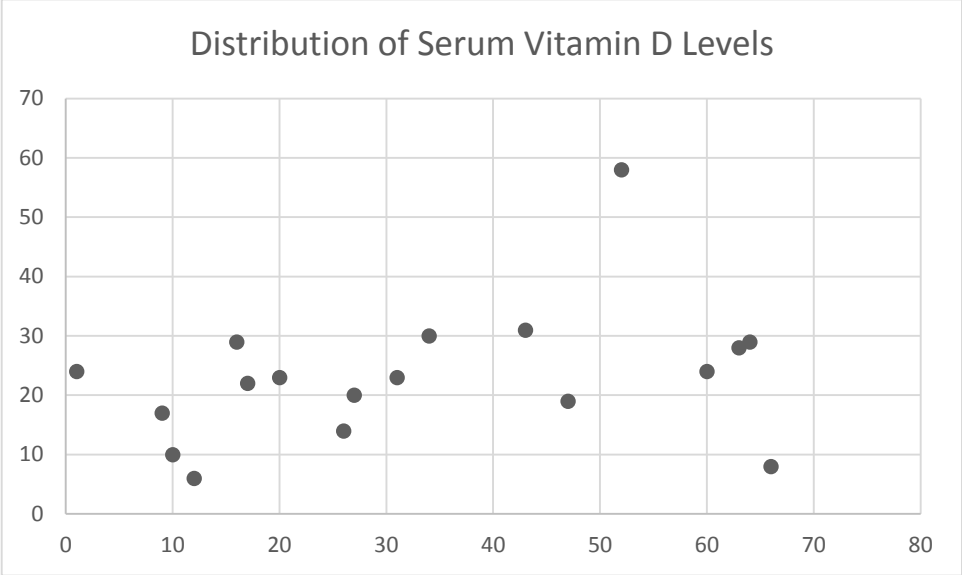


Figure 14:

Biceps:

Tendinopathic Changes:

Tendinopathic changes in the biceps tendon

		MRI		
		Tendinopathic changes	Normal	
USG	Tendinopathic changes	2	3	5
	Normal	6	56	62
		8	59	67

Sensitivity	2/5	40.00%
Specificity	56/62	90.32%
PPV	2/8	25.00%
NPV	56/59	94.92%
Accuracy	58/67	86.57%

	Evaluation on MRI			
	Tendinopathic changes in the Biceps muscles			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender		**0.014**	Significant
2	Age (</= 45 years and > 45 years)		**0.006**	Significant
3	Handedness		0.864	
4	Occupation		0.441	
5	Smoking		0.595	
6	Trauma		0.391	
7	Diabetes		0.173	
8	Hypertension		**0.040**	Significant

9	Total Cholesterol (normal <150 mg/dL)		0.326	
10	Triglycerides (normal <160 mg/dL)		0.588	
11	LDL (normal <100 mg/dL)		0.222	
12	HDL (> 40 mg/dL)		0.314	
13	Vit. D (normal > 30 ng/ml)		0.314	

Table 3:

Fluid along the biceps tendon:

Fluid along biceps tendon

		MRI		
		Fluid	Normal	
USG	Fluid	25	8	33
	Normal	24	12	36
		49	20	69

Sensitivity	25/33	75.76%
Specificity	12/36	33.33%
PPV	25/49	51.02%
NPV	12/20	60.00%
Accuracy	37/69	53.62%

	Evaluation on MRI			
	Fluid along the biceps tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender		0.620	
2	Age (</= 45 years and > 45 years)		0.259	
3	Handedness	0.548		
4	Occupation		0.236	
5	Smoking		0.613	
6	Trauma	0.157		
7	Diabetes		0.138	
8	Hypertension		0.281	
9	Total Cholesterol (normal <150 mg/dL)		0.227	
10	Triglycerides (normal <160 mg/dL)		0.542	
11	LDL (normal <100 mg/dL)		0.319	
12	HDL (> 40 mg/dL)		0.578	
13	Vit. D (normal > 30 ng/ml)		0.490	

Table 4:

Dislocation of Biceps Tendon:

Dislocated biceps tendon

		MRI		
		Dislocation	Normal	
USG	Dislocation	1	2	3
	Normal	3	62	65
		4	64	68

Sensitivity	1/3	33.33%
Specificity	62/65	95.38%
PPV	1/4	25.00%
NPV	62/64	96.88%
Accuracy	63/68	92.65%

	Evaluation on MRI			
	Dislocation of the Biceps tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender		0.062	
2	Age (</= 45 years and > 45 years)		0.544	
3	Handedness		0.913	
4	Occupation		0.504	
5	Smoking		0.615	
6	Trauma		0.500	
7	Diabetes		0.596	
8	Hypertension		0.516	
9	Total Cholesterol (normal <150 mg/dL)		0.632	

10	Triglycerides (normal <160 mg/dL)		0.474	
11	LDL (normal <100 mg/dL)		0.700	
12	HDL (> 40 mg/dL)		0.158	
13	Vit. D (normal > 30 ng/ml)		0.784	

Table 5:

Subscapularis Tendon:

Tendinopathic Changes in the Subscapularis Tendon:

Tendinopathic Changes in the Subscapularis Tendon:

		MRI		
		Tendinopathic Changes	Normal	
USG	Tendinopathic Changes	11	8	19
	Normal	13	38	51
		24	46	70

Sensitivity	11/19	58%
Specificity	38/51	74.51%
PPV	11/24	46%
NPV	38/46	82.61%
Accuracy	49/70	70%

	Evaluation on MRI			
	Tendinopathic changes in the subscapularis tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender	0.599		
2	Age (</= 45 years and > 45 years)	0.108		
3	Handedness		0.348	
4	Occupation		**0.012**	Significant
5	Smoking	0.433		
6	Trauma	0.790		
7	Diabetes		0.105	
8	Hypertension		**0.012**	Significant
9	Total Cholesterol (normal <150 mg/dL)		0.663	
10	Triglycerides (normal <160 mg/dL)		0.255	
11	LDL (normal <100 mg/dL)		0.574	
12	HDL (> 40 mg/dL)		0.058	
13	Vit. D (normal > 30 ng/ml)		0.641	

Table 6:

Partial Thickness Tear of Subscapularis:

Partial Thickness Tear of the Subscapularis Tendon:

		MRI		
		Partial Thickness Tear	Normal	
USG	Partial Thickness Tear	3	5	8
	Normal	10	52	62
		13	57	70

Sensitivity	41854	38%
Specificity	52/62	83.87%
PPV	41334	23%
NPV	52/57	91.23%
Accuracy	55/70	78.50%

	Evaluation on MRI			
	Tear in the subscapularis tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender	0.872		
2	Age (</= 45 years and > 45 years)		0.448	
3	Handedness		0.152	
4	Occupation		0.188	
5	Smoking		0.467	
6	Trauma		0.500	
7	Diabetes		0.720	
8	Hypertension		0.086	

9	Total Cholesterol (normal <150 mg/dL)		0.704	
10	Triglycerides (normal <160 mg/dL)		0.087	
11	LDL (normal <100 mg/dL)		0.681	
12	HDL (> 40 mg/dL)		0.578	
13	Vit. D (normal > 30 ng/ml)		0.510	

Table 7:

Supraspinatus Tendon:

Tendinopathic Changes:

Tendinopathic Changes in the Supraspinatus Tendon

		MRI		
		Tendinopathic Changes	Normal	
USG	Tendinopathic Changes	35	13	48
	Normal	7	12	19
		42	24	67

Sensitivity	35/48	73%
Specificity	12/19	63.16%
PPV	35/42	83%
NPV	12/24	50.00%
Accuracy	47/67	70.10%

	Evaluation on MRI			
	Tendinopathic changes in the supraspinatus tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender		0.128	
2	Age (</= 45 years and > 45 years)		**0.001**	Significant
3	Handedness		0.391	
4	Occupation		0.421	
5	Smoking		0.207	
6	Trauma	0.606		
7	Diabetes		0.309	
8	Hypertension		**0.013**	Significant
9	Total Cholesterol (normal <150 mg/dL)		0.704	
10	Triglycerides (normal <160 mg/dL)		0.542	
11	LDL (normal <100 mg/dL)		0.681	
12	HDL (> 40 mg/dL)		0.578	
13	Vit. D (normal > 30 ng/ml)		0.595	

Table 8:

Any Tear of the Supraspinatus Tendon:

Tear in the Supraspinatus Tendon

		MRI		
		Tear	Normal	
USG	Tear	31	6	37
	Normal	4	26	33
		35	35	70

Sensitivity	31/37	84%
Specificity	26/33	78.79%
PPV	31/35	89%
NPV	26/35	74.29%
Accuracy	57/70	81.43%

	Evaluation on MRI			
	Tear in the supraspinatus tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender	0.382		
2	Age (</= 45 years and > 45 years)		**0.001**	Significant
3	Handedness		0.565	
4	Occupation		0.310	
5	Smoking	0.412		
6	Trauma	0.802		
7	Diabetes		0.091	
8	Hypertension		**0.000**	Significant
9	Total Cholesterol (normal <150 mg/dL)		0.474	

10	Triglycerides (normal <160 mg/dL)		0.430	
11	LDL (normal <100 mg/dL)		0.664	
12	HDL (> 40 mg/dL)		0.296	
13	Vit. D (normal > 30 ng/ml)		0.431	

Table 9:

Complete Vs Partial Tear of the Supraspinatus Tendon:

Type of Tear of the Supraspinatus Tendon

		MRI		
		Complete Tear	Partial Tear	
USG	Complete Tear	5	1	6
	Partial Tear	7	18	25
		12	19	31

	Evaluation on MRI			
	Type of tear of the supraspinatus Tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender		0.177	
2	Age (</= 45 years and > 45 years)		0.102	
3	Handedness			
4	Occupation		0.603	
5	Smoking		0.120	
6	Trauma		0.602	
7	Diabetes		0.658	
8	Hypertension		0.367	
9	Total Cholesterol (normal <150 mg/dL)		0.311	
10	Triglycerides (normal <160 mg/dL)		0.689	
11	LDL (normal <100 mg/dL)		0.217	
12	HDL (> 40 mg/dL)		0.417	
13	Vit. D (normal > 30 ng/ml)		0.227	

Table 10:

Infraspinatus Tendon:

Tendinopathic changes:

Tendinopathic Changes in the Infraspinatus Tendon

		MRI		
		Tendinopathic Changes	Normal	
USG	Tendinopathic Changes	4	7	11
	Normal	11	45	56
		15	52	67

Sensitivity	4/11	36%
Specificity	45/56	80.36%
PPV	4/15	27%
NPV	45/52	86.54%
Accuracy	49/67	73.13%

	Evaluation on MRI			
	Tendinopathic changes in the infraspinatus tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender		0.582	
2	Age (</= 45 years and > 45 years)	0.020		
3	Handedness		0.739	
4	Occupation		0.179	
5	Smoking		0.157	
6	Trauma	0.564		
7	Diabetes		0.519	
8	Hypertension		0.109	

9	Total Cholesterol (normal <150 mg/dL)		0.366	
10	Triglycerides (normal <160 mg/dL)		0.119	
11	LDL (normal <100 mg/dL)		0.387	
12	HDL (> 40 mg/dL)		0.155	
13	Vit. D (normal > 30 ng/ml)		0.595	

Table 11:

Tear of the Infraspinatus Tendon:

Tear of the Infraspinatus Tendon

		MRI		
		Tear	Normal	
USG	Tear	4	3	7
	Normal	4	59	63
		8	62	70

Sensitivity	4/7	57%
Specificity	59/63	93.65%
PPV	4/8	50%
NPV	59/62	95.16%
Accuracy	63/70	90.00%

	Evaluation on MRI			
	Type of tear of the infraspinatus tendon			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender		0.451	
2	Age (</= 45 years and > 45 years)		0.075	
3	Handedness		0.913	
4	Occupation		0.258	
5	Smoking		0.264	
6	Trauma		0.336	
7	Diabetes		0.478	
8	Hypertension		0.154	
9	Total Cholesterol (normal <150 mg/dL)		0.386	
10	Triglycerides (normal <160 mg/dL)		0.211	
11	LDL (normal <100 mg/dL)		0.319	
12	HDL (> 40 mg/dL)		0.702	
13	Vit. D (normal > 30 ng/ml)		0.784	

Table 12:

Any Tendon tear (including tendinopathic changes and any tears):

		Presence of any tear MRI Any tear	Normal	
USG	Any tear	38	14	52
	Normal	18	137	155
		56	151	207

Sensitivity	38/52	73.08%
Specificity	137/155	88.39%
Positive predictive value	38/56	67.86%
Negative predictive value	137/151	90.73%
Accuracy	175/207	84.54%

Subacromial and Subdeltoid Bursitis:

Subacromial Subdeltoid Bursitis

			MRI	
		Bursitis	Normal	
USG	Bursitis	39	9	48
	Normal	12	9	21
		51	18	69

Sensitivity	39/48	81%
Specificity	9/21	42.86%
PPV	39/51	76%
NPV	9/18	50.00%
Accuracy	48/69	69.57%

	Evaluation on MRI			
	Subacromial subdeltoid bursitis			
Sr. No.	Variable	Test Value		Significance
		Pearson Chi-Square Test	Fisher's Exact Test	
1	Gender		0.065	
2	Age (</= 45 years and > 45 years)		**0.004**	Significant
3	Handedness		0.804	
4	Occupation		0.382	
5	Smoking		0.387	
6	Trauma		**0.044**	Significant
7	Diabetes		0.599	
8	Hypertension		0.113	
9	Total Cholesterol (normal <150 mg/dL)		0.632	
10	Triglycerides (normal <160 mg/dL)		0.526	
11	LDL (normal <100 mg/dL)		0.700	
12	HDL (> 40 mg/dL)		0.842	
13	Vit. D (normal > 30 ng/ml)		0.686	

Table 13:

Acromio-Clavicular Joint Arthritis:

Acromio-clavicular joint arthritis

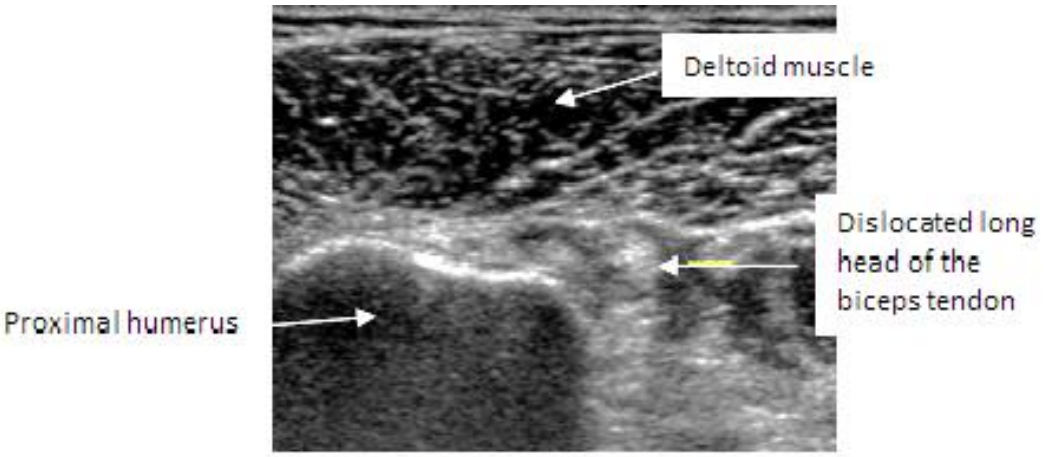
		MRI Arthritis	Normal	
USG	Arthritis	45	12	57
	Normal	3	7	10
		48	19	67

Sensitivity	45/57	78.95%
Specificity	7/10	70.00%
PPV	45/48	93.75%
NPV	7/19	36.84%
Accuracy	52/67	77.61%

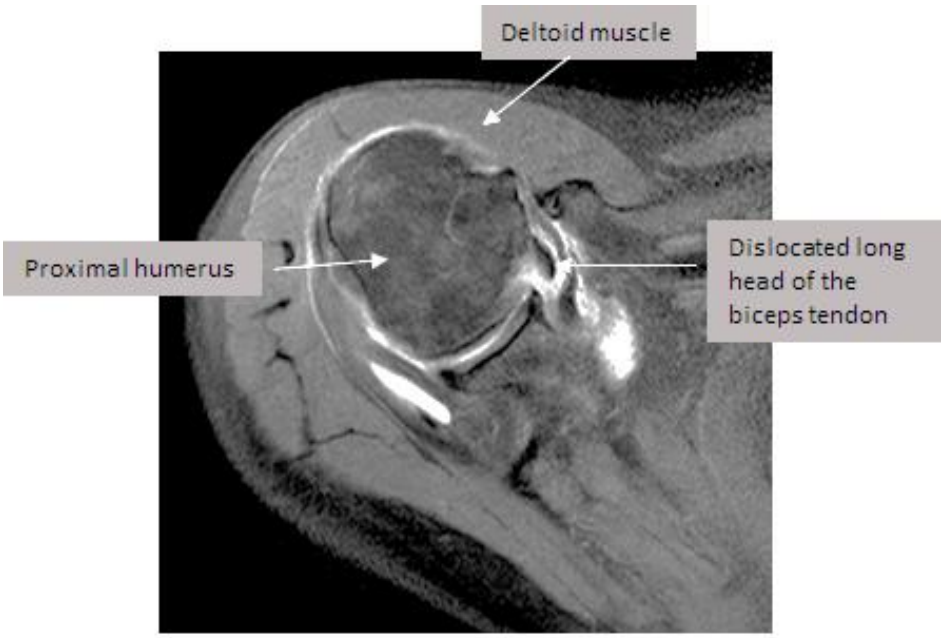
Imaging Pathology:

Biceps tendon:

1. Dislocation:

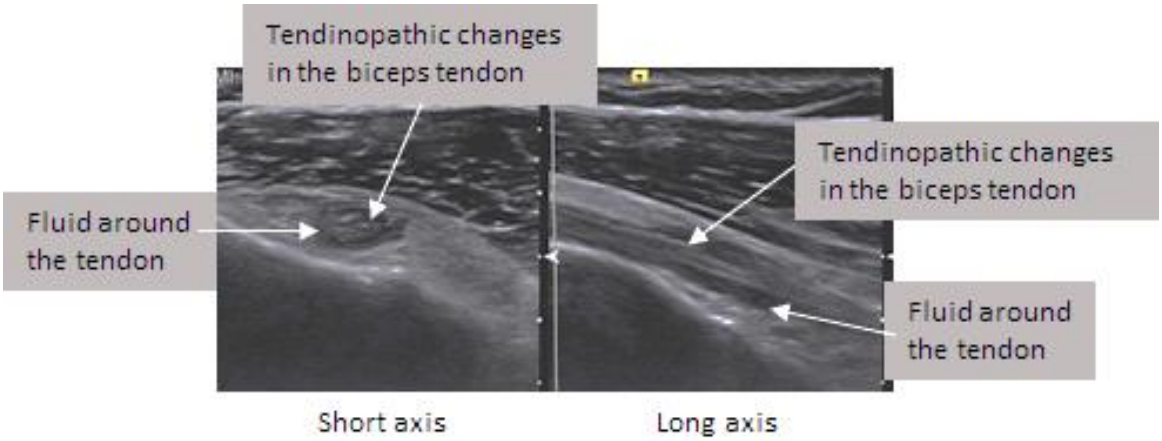


Biceps tendon dislocation

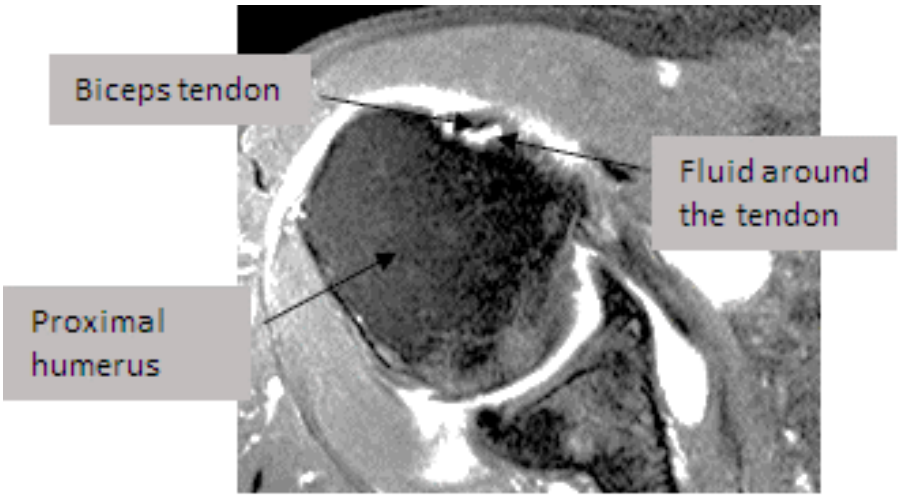


Biceps tendon dislocation
MRI – proton density SPAIR axial section

2. Fluid along the biceps tendon sheath:

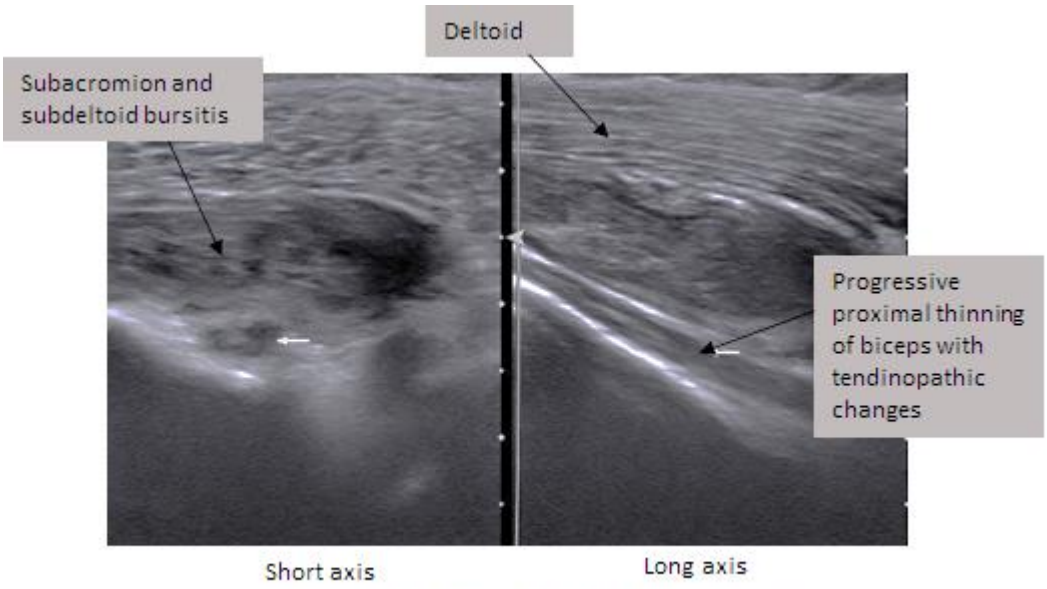


Right biceps with fluid around the tendon - USG



Right biceps with fluid around the tendon – MRI T2W axial section

3. Tendinopathic changes in the biceps tendon

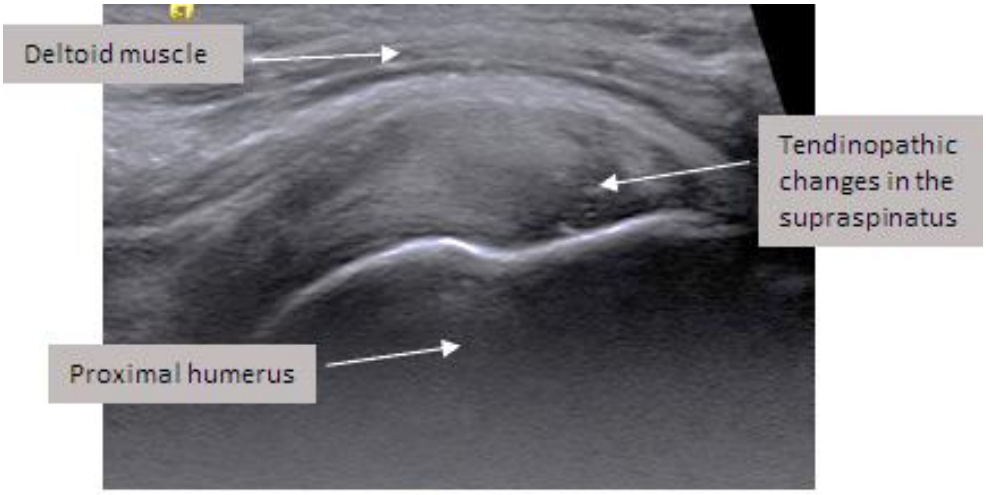


Biceps tendon showing tendinopathic changes

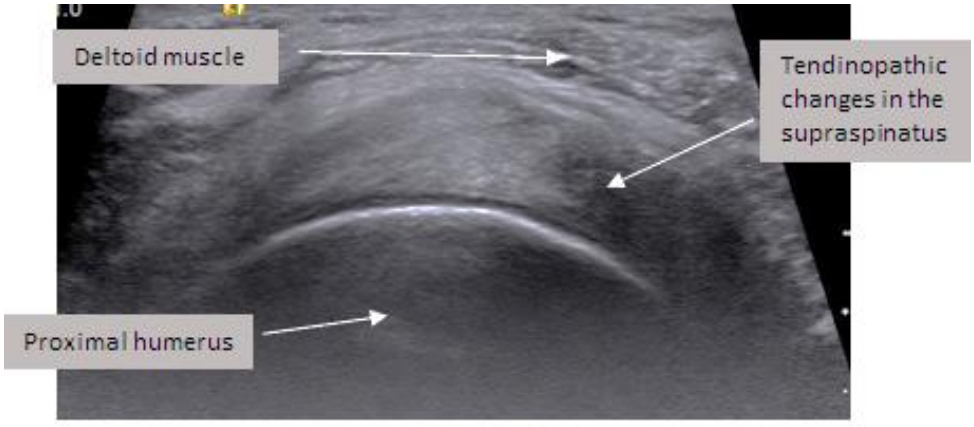
Biceps tendon showing tendinopathic changes – Proton density SPAIR image

Supraspinatus tendon:

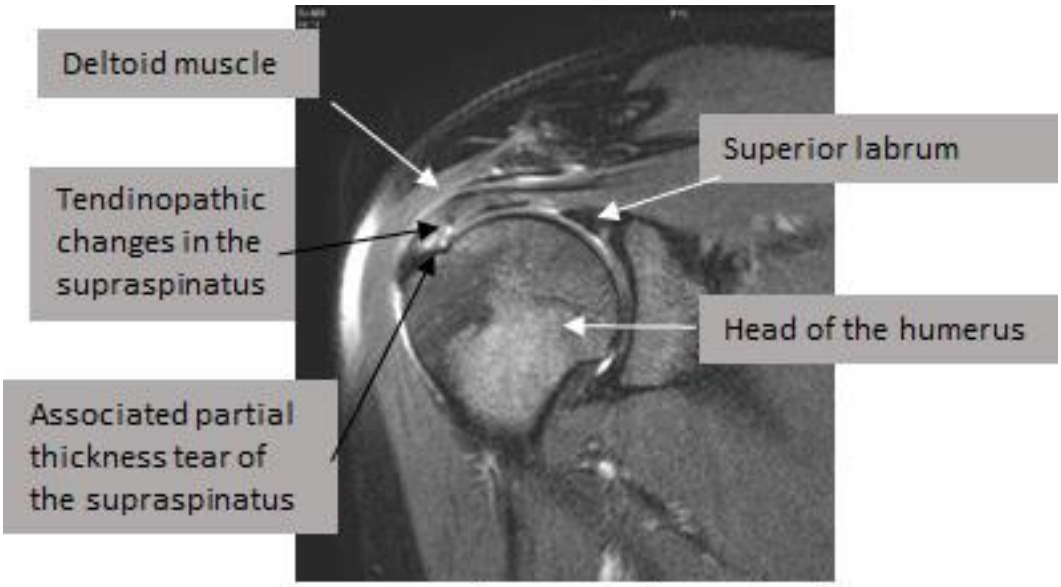
1. Tendinopathic changes in the supraspinatus tendon:



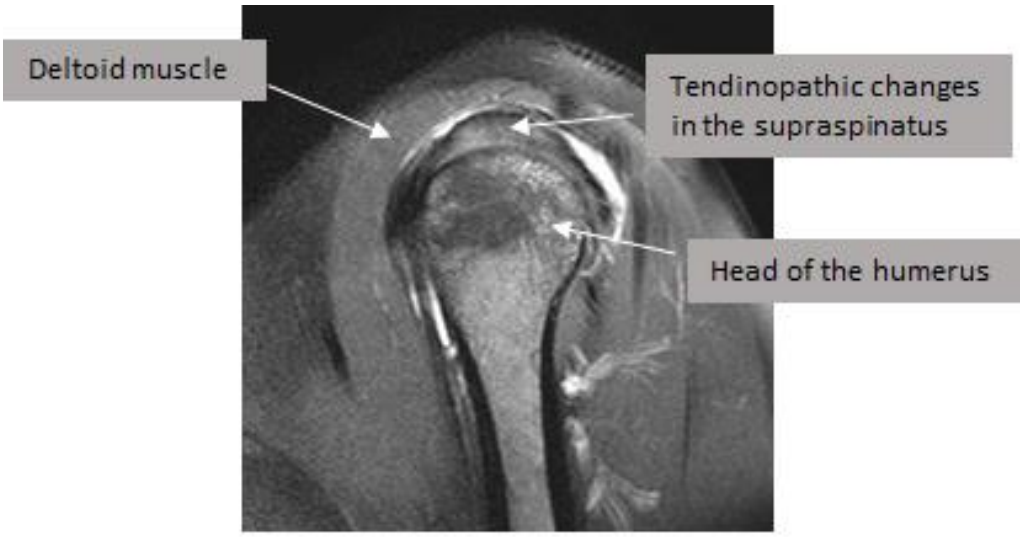
Long axis
Supraspinatus showing tendinopathic changes – USG



Short axis
Supraspinatus showing tendinopathic changes – USG

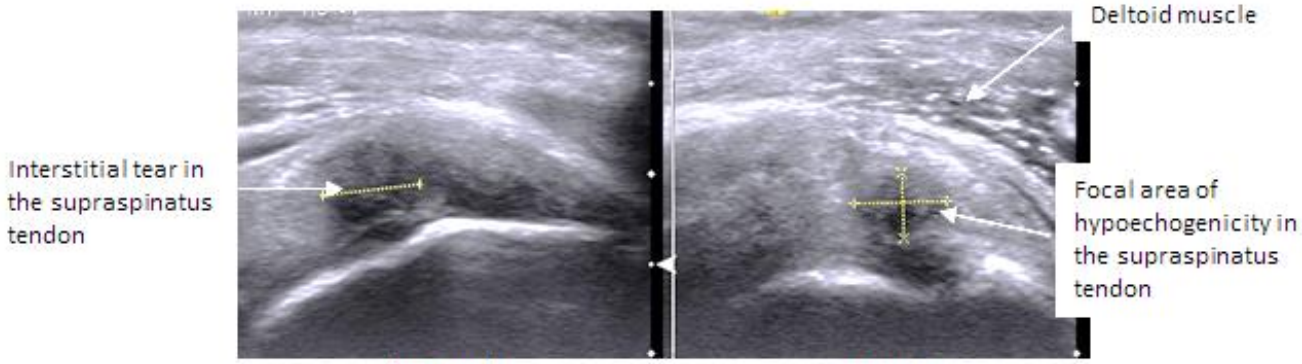


Supraspinatus showing tendinopathic changes – MRI proton density coronal section

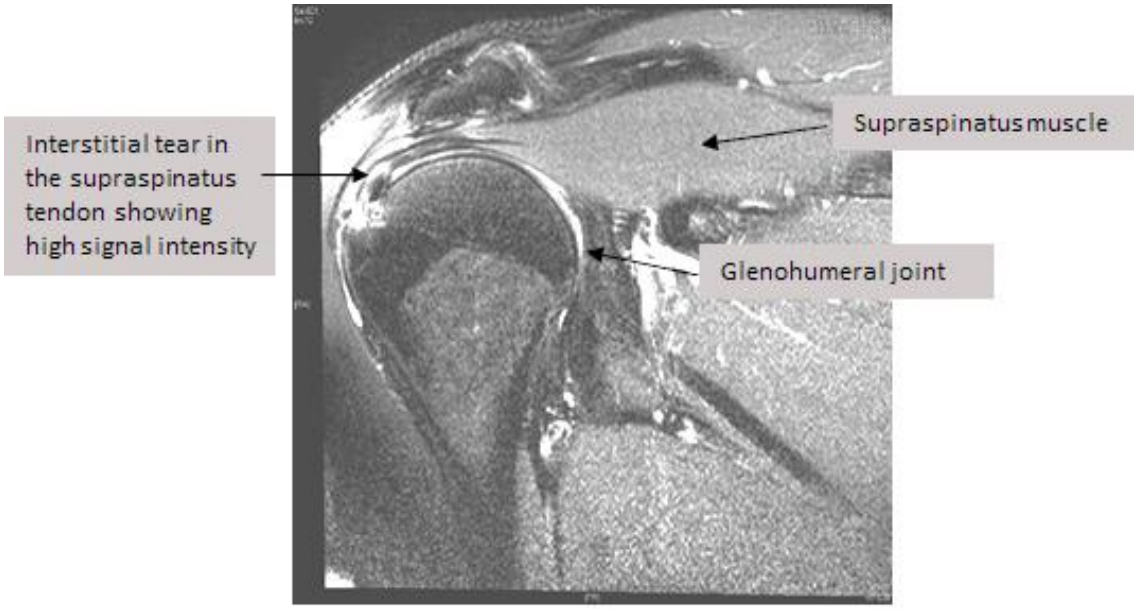


Supraspinatus showing tendinopathic changes – MRI proton T2W SPAIR sagittal section

2. Interstitial tear of the supraspinatus tendon

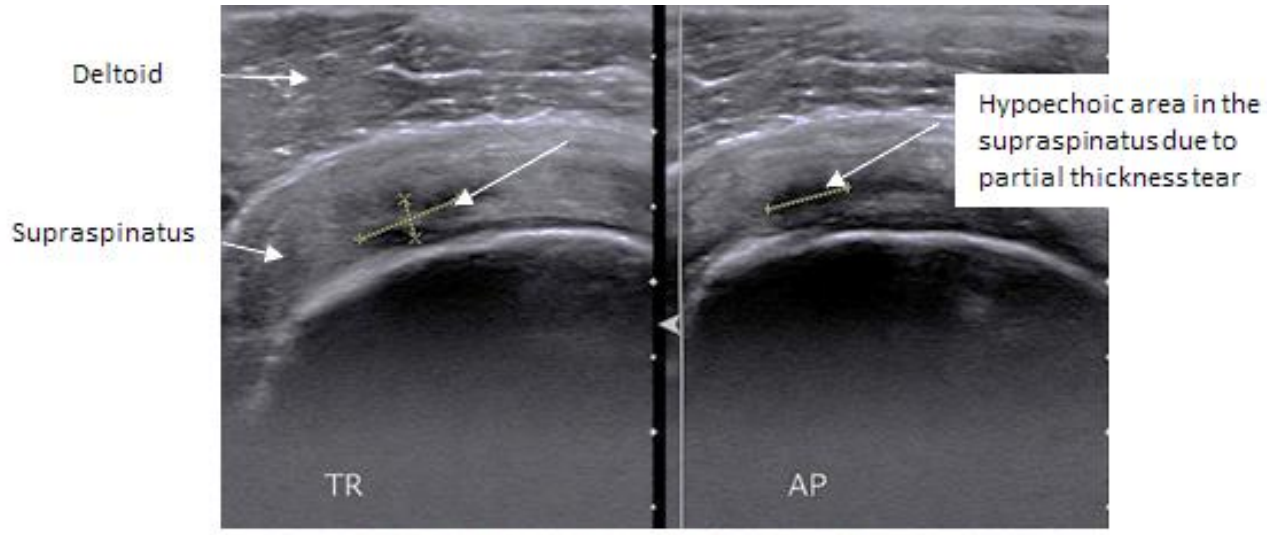


Interstitial tear in the supraspinatus tendon- USG



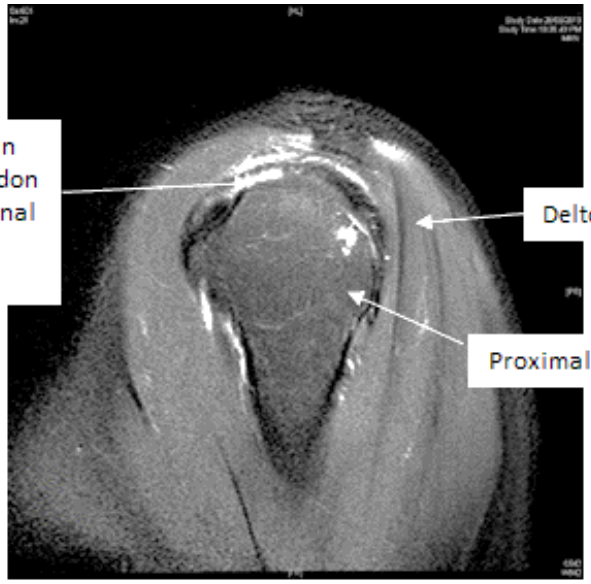
Interstitial tear in the supraspinatus tendon- MRI T2W coronal section

3. Partial thickness tear of the supraspinatus:



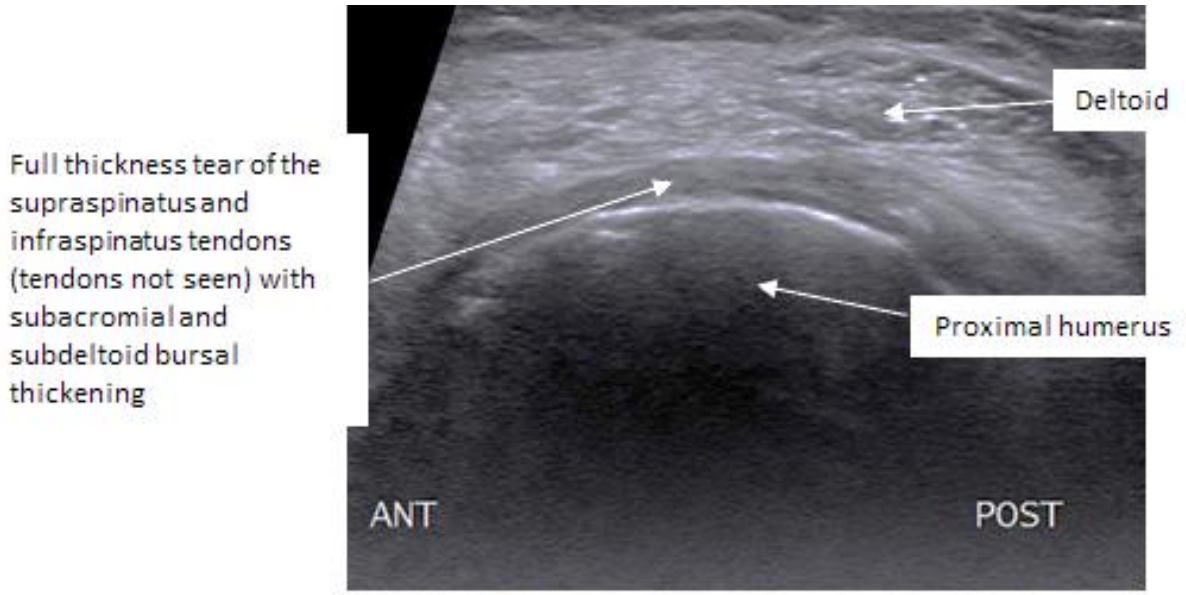
Supraspinatus partial thickness tear (short axis)

Supraspinatus partial thickness tear (long axis)



Supraspinatus partial thickness (articular) tear (T2W sagittal section)

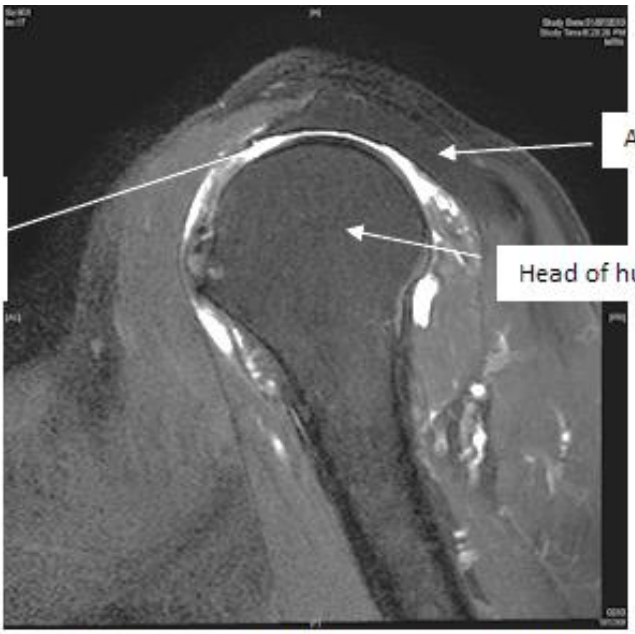
4. Full thickness tear of the supraspinatus tendon:



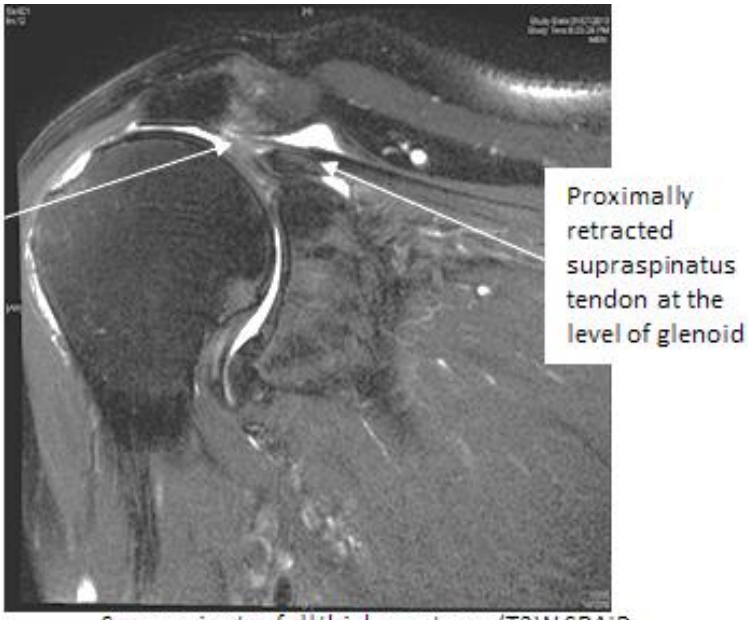
Full thickness tear of the supraspinatus and infraspinatus tendon (short axis)

Supraspinatus full thickness tear (Proton density sagittal section)

Supraspinatus full thickness tear (Proton density coronal section)

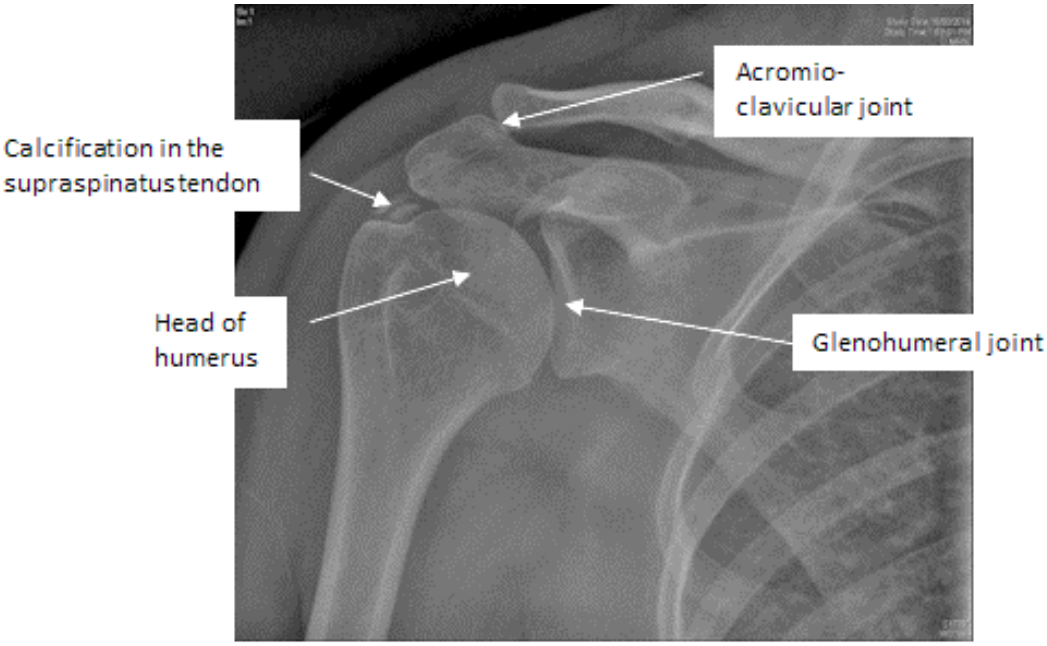


Supraspinatus full thickness tear (T2W SPAIR sagittal section)

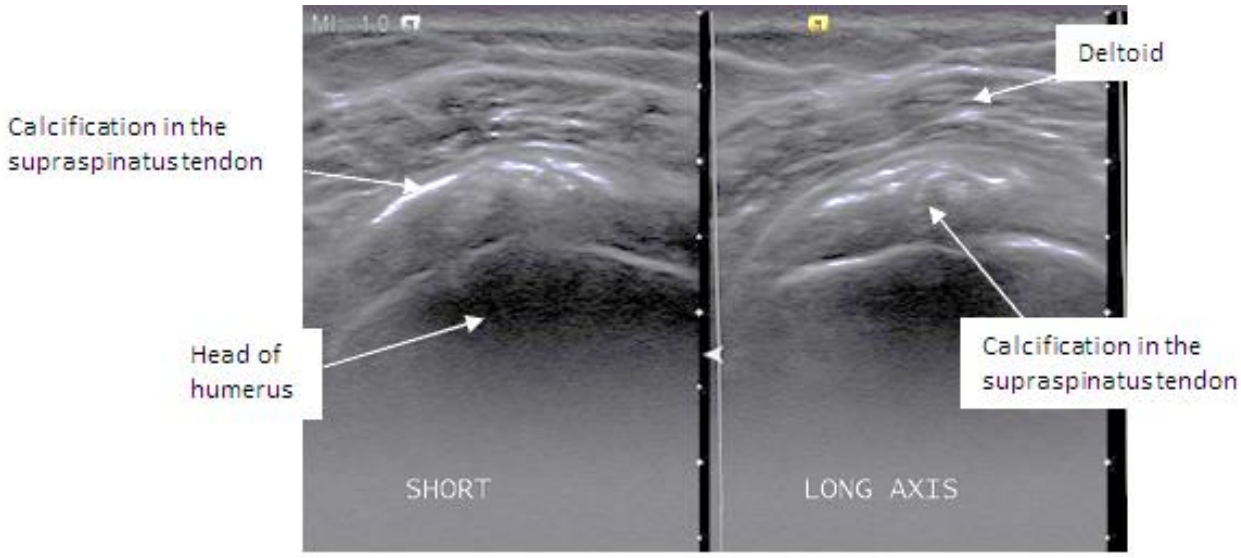


Supraspinatus full thickness tears (T2W SPAIR Coronal section)

5. Supraspinatus calcific tendinosis:

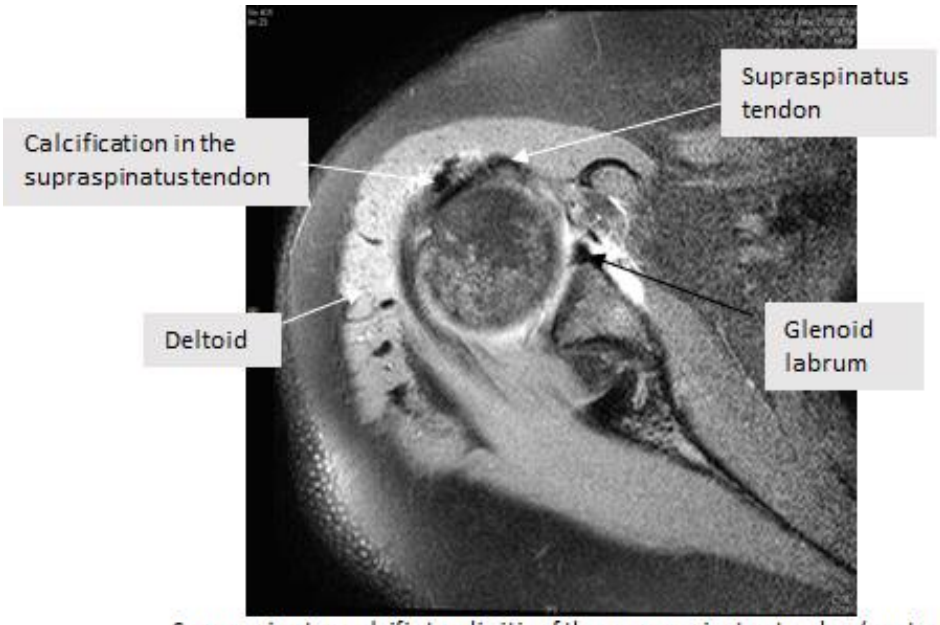


Plain radiograph showing calcification in the supraspinatus tendon



Ultrasound showing calcification in the supraspinatus tendon

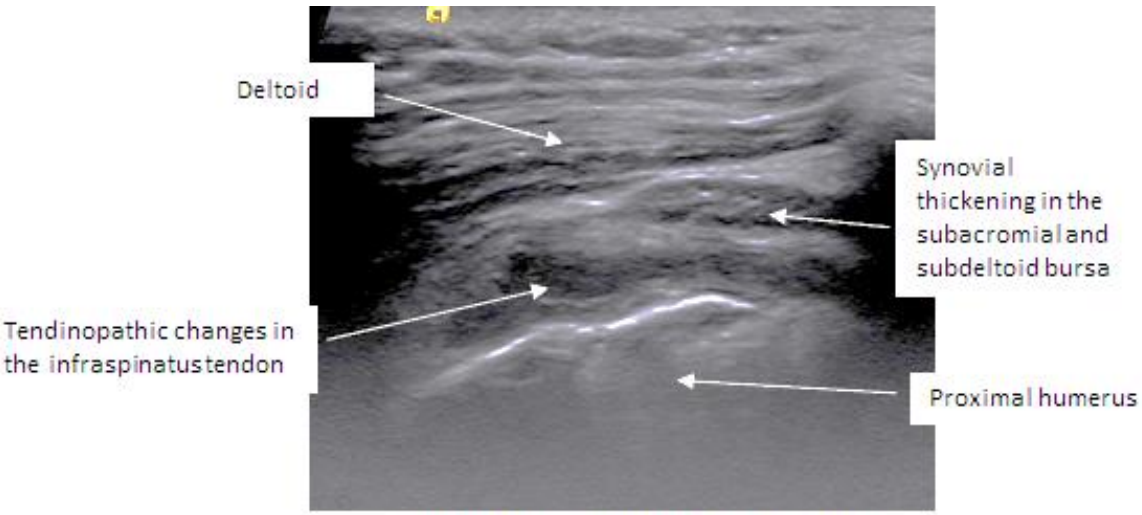
Supraspinatus calcific tendinitis of the supraspinatus tendon (T1W coronal section)



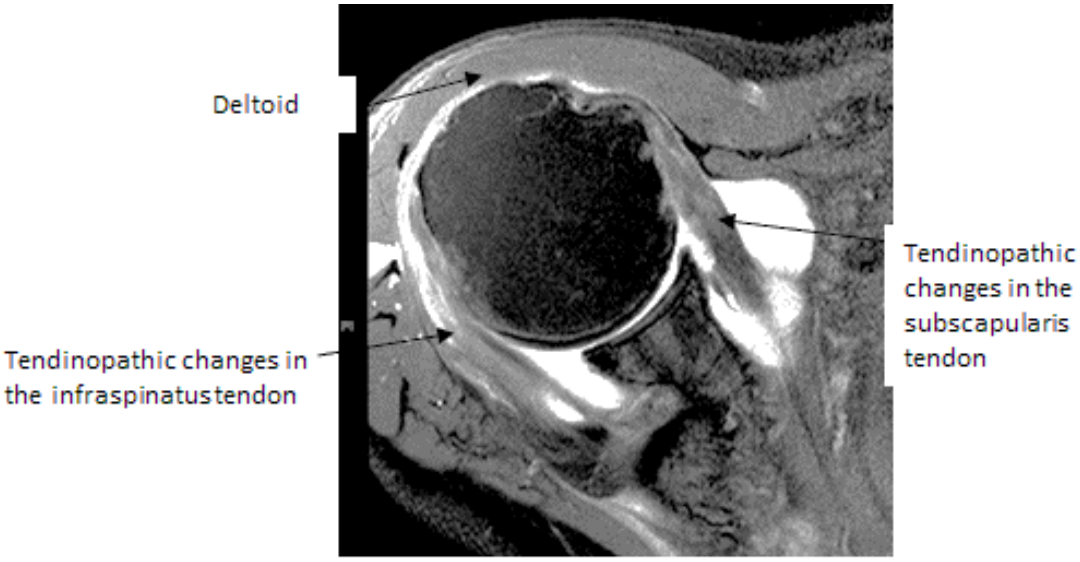
Supraspinatus calcific tendinitis of the supraspinatus tendon (proton density axial section)

Infraspinatus tendon:

1. Tendinopathic changes in the infraspinatus:

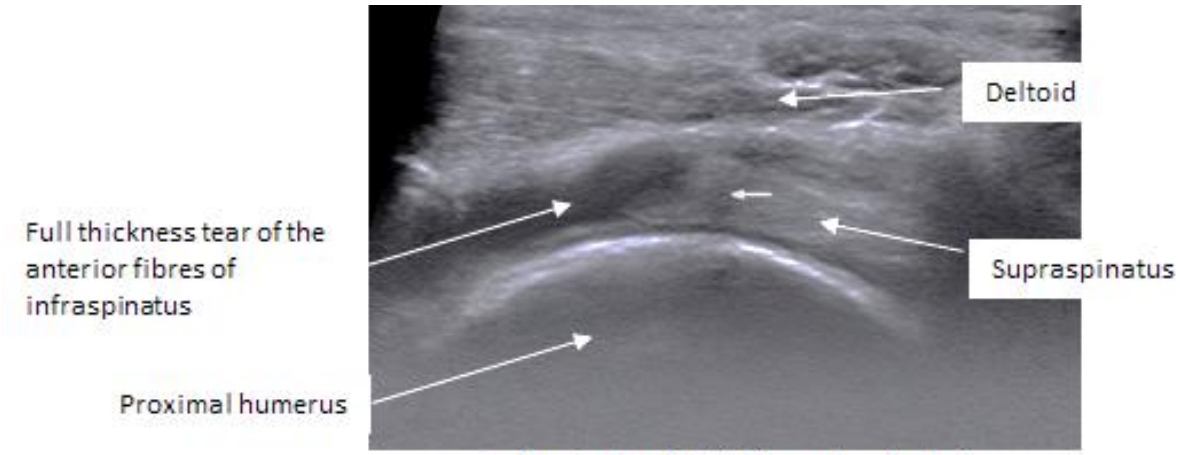


Tendinopathic changes in the infraspinatus tendon (long axis)

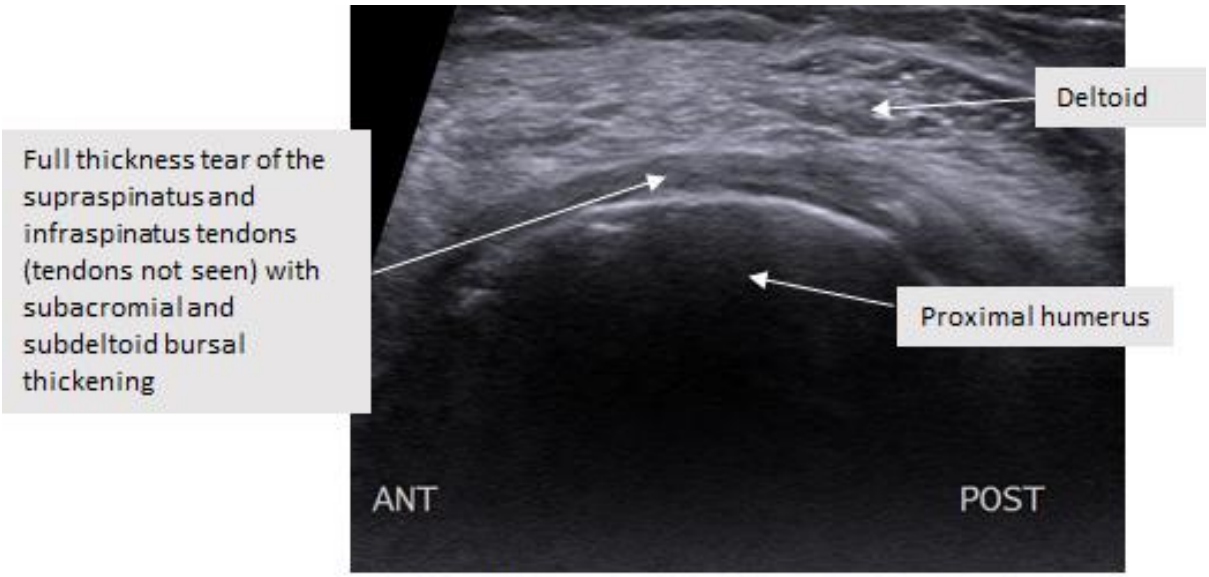


Tendinopathic changes in the infraspinatus tendon (proton density axial section)

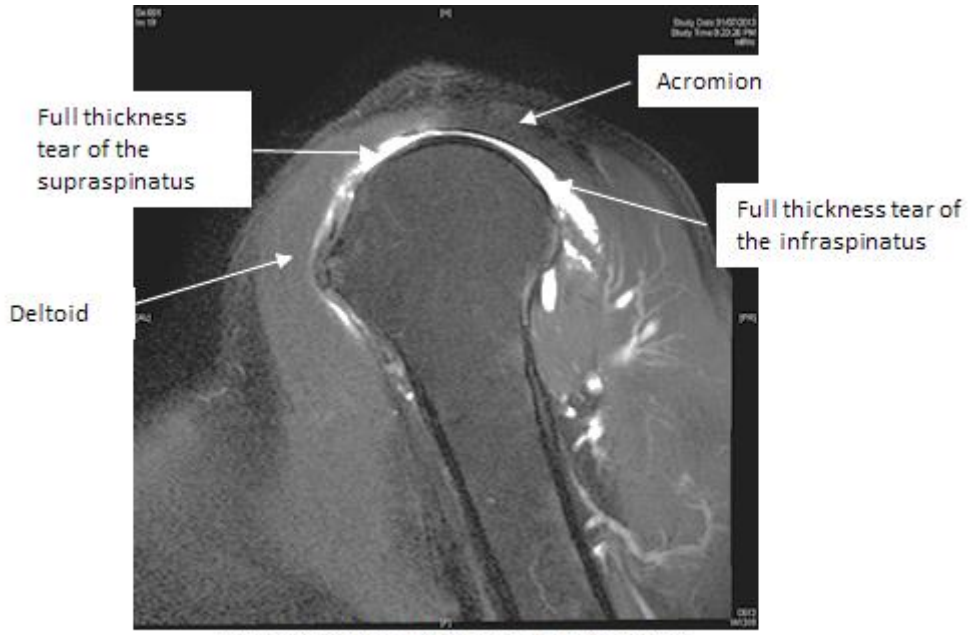
2. Full thickness tear in the infraspinatus:



Infraspinatus full thickness tear (anterior aspect) - short axis



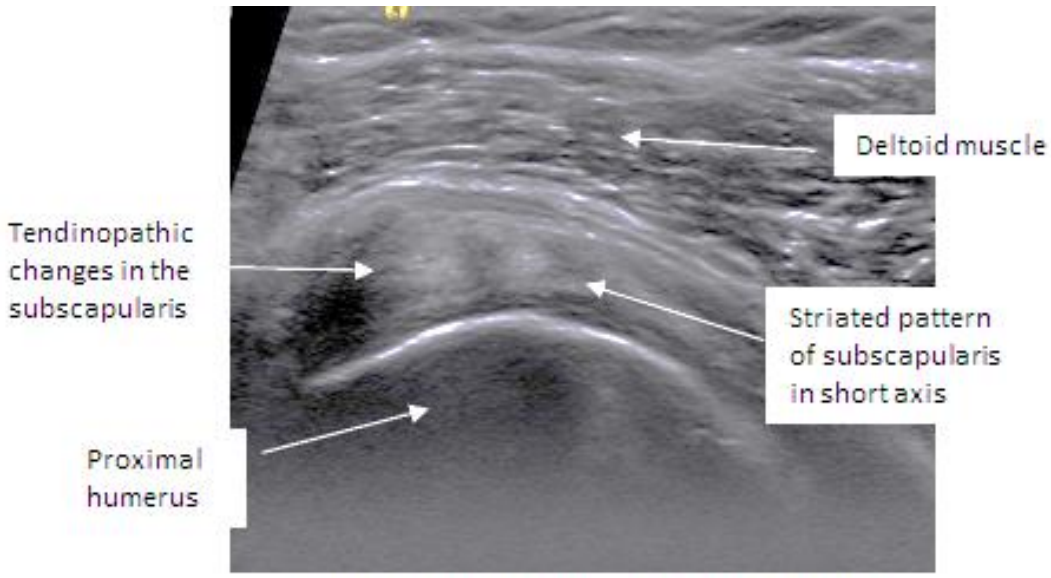
Full thickness tear of the supraspinatus and infraspinatus tendon (short axis)



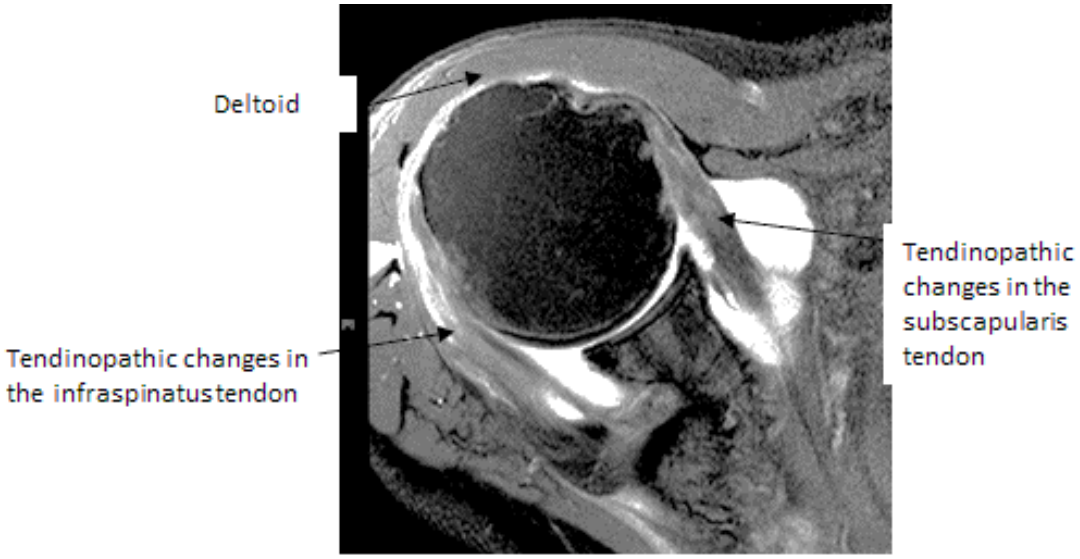
Infraspinatus full thickness tear (T2W SPAIR sagittal section)

Subscapularis:

1. Tendinopathic changes in the subscapularis tendon:

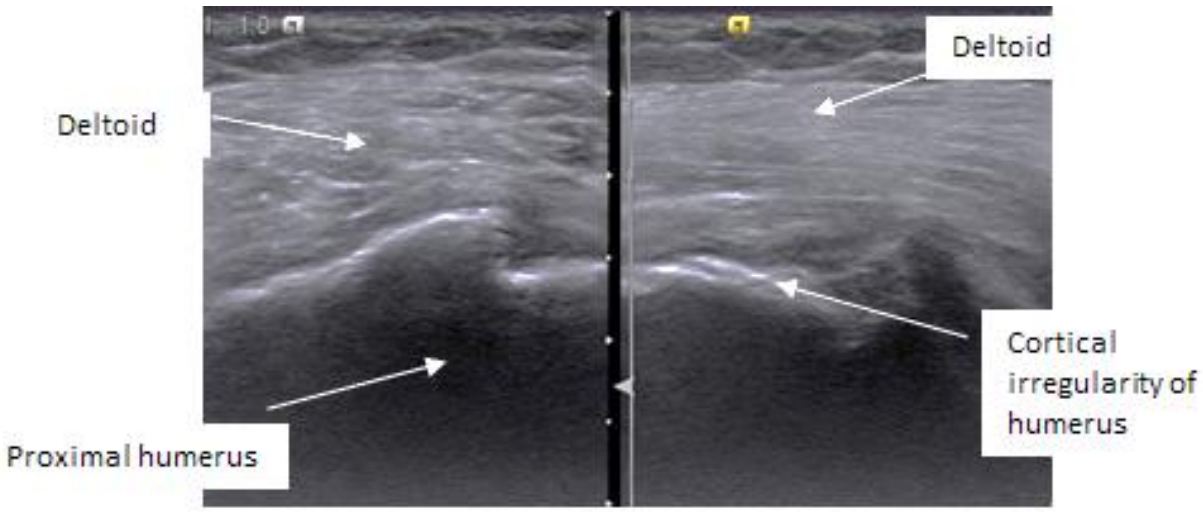


Tendinopathic changes in the subscapularis muscle (short axis)

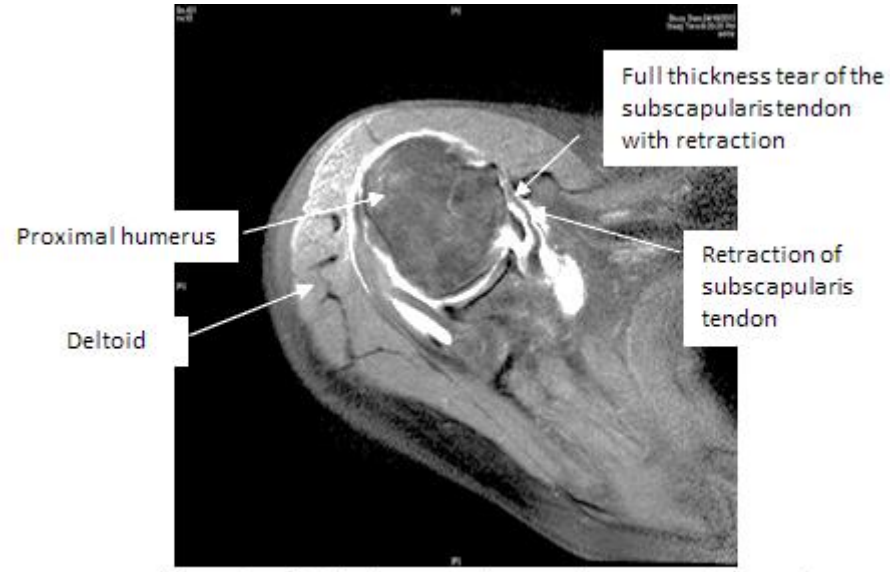


Tendinopathic changes in the subscapularis tendon (proton density axial section)

2. Full thickness tear of the subscapularis:



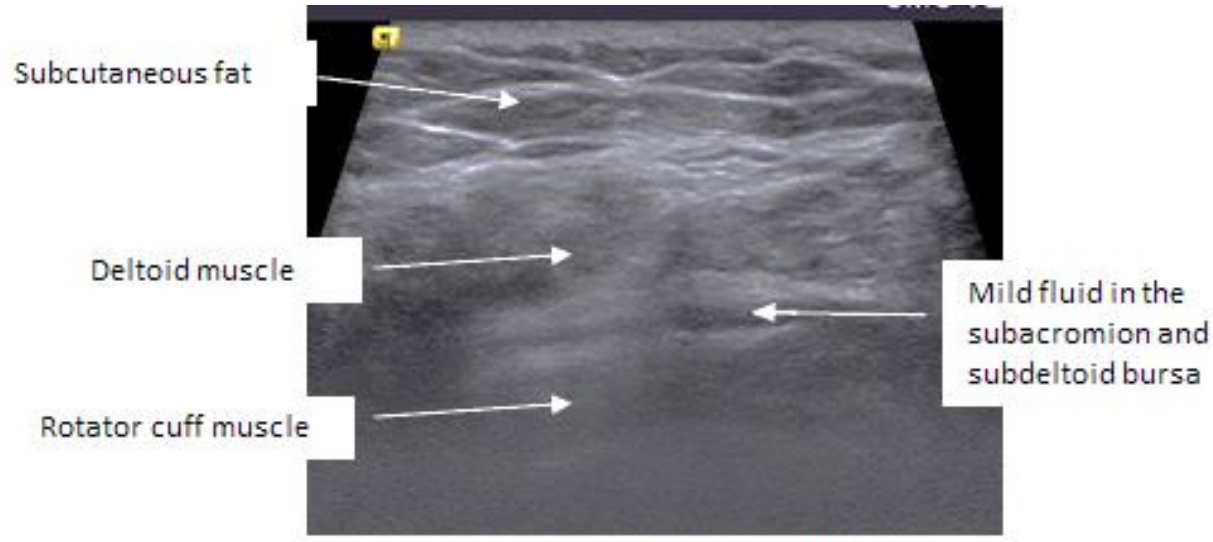
Full thickness tear of the subscapularis (subscapularis tendon not seen)



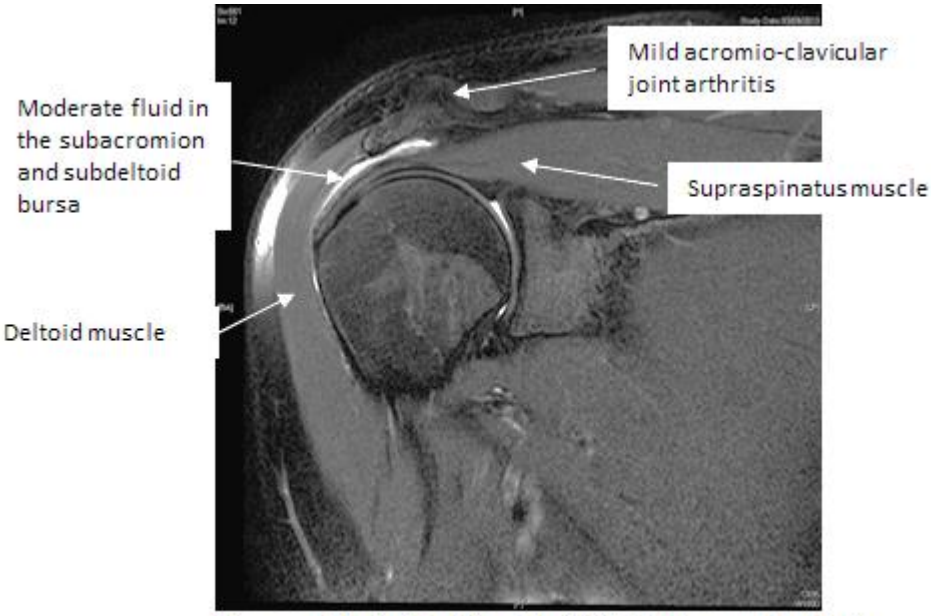
Subscapularis full thickness tear (proton density axial section)

Subacromion and subdeltoid bursitis:

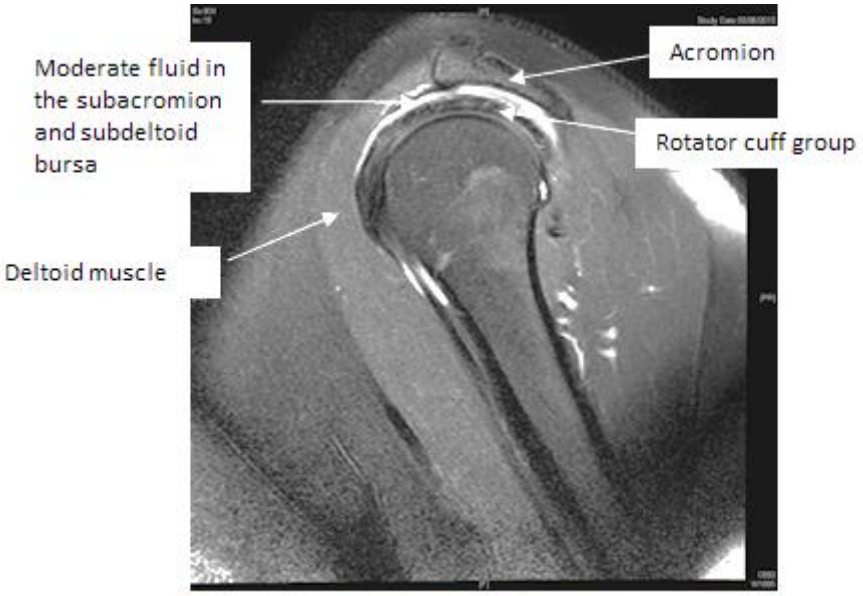
1. Subacromion and subdeltoid bursitis:



Subacromial and subdeltoid bursitis

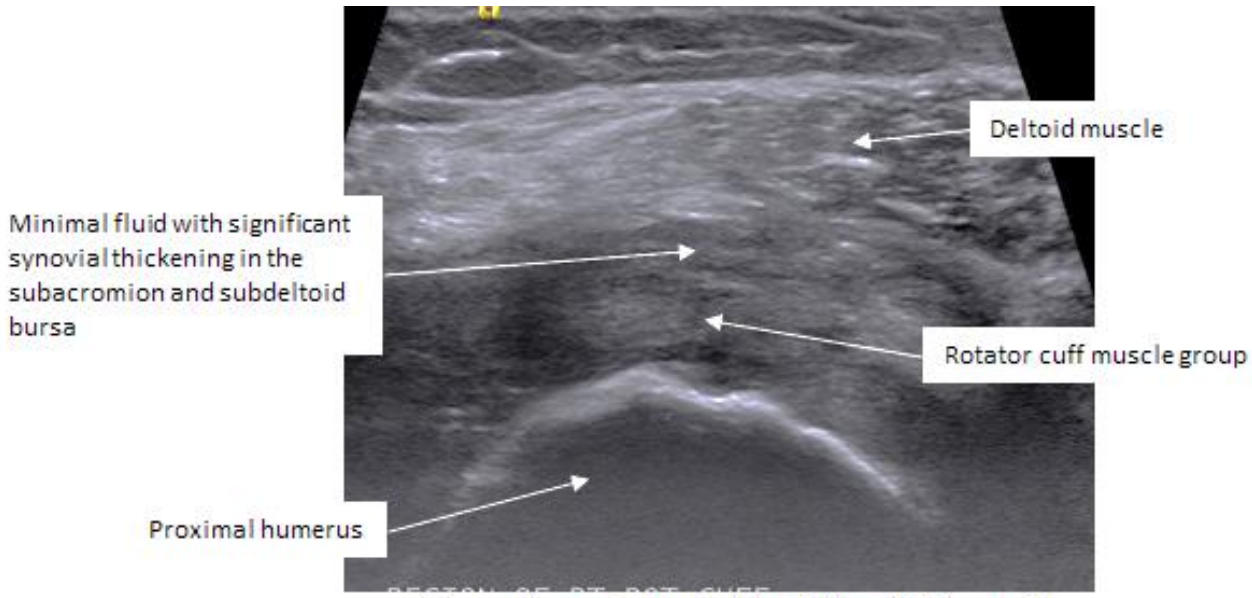


Subacromial subdeltoid bursitis (T2W SPAIR coronal section)

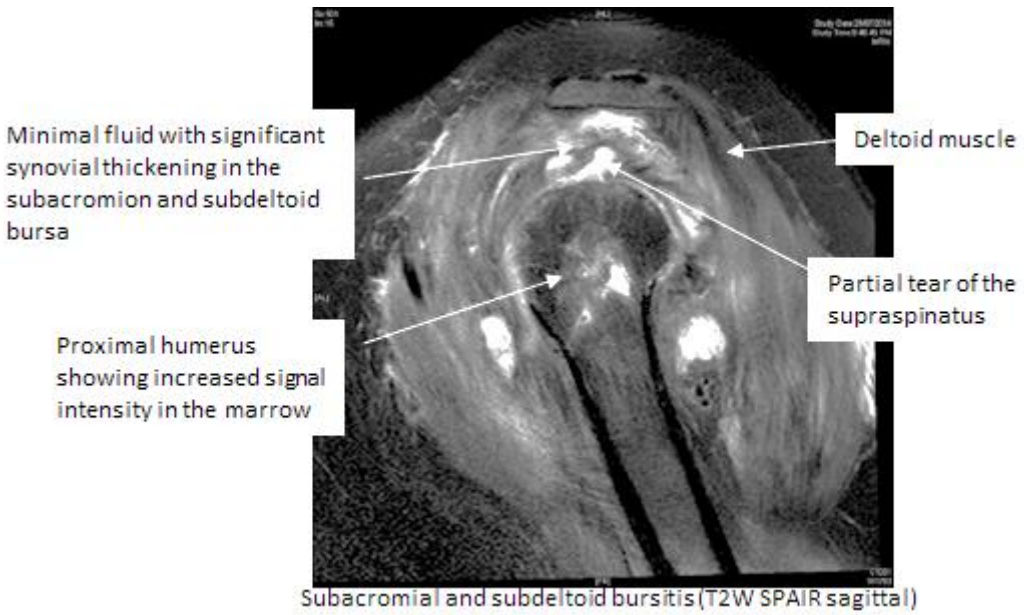


Subacromial subdeltoid bursitis (T2W SPAIR sagittal section)

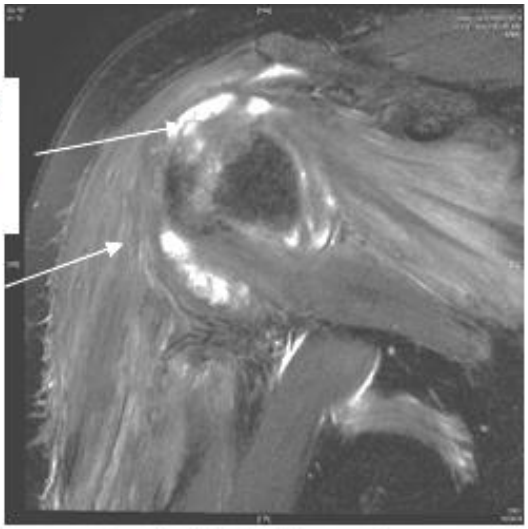
2. Sever subacromial and subdeltoid bursitis:



Sever subacromial and subdeltoid bursitis (short axis)



Subacromial and subdeltoid bursitis (T2W SPAIR sagittal)



Subacromial and subdeltoid bursitis (T2W SPAIR coronal)

Discussion:

A total of 70 subjects were enrolled in this study who had both MRI and ultrasound of their shoulder joint. Subjects were assessed for rotator cuff abnormalities. 55 were men and 15 were women. The average age of the subjects was 39 (+/- 12.6) years and it was 38.3 (+/- 12.6) years and 44.4 (+/- 12) years for men and women respectively.

Right shoulder was evaluated in 45 subjects and left shoulder was evaluated in 25 subjects. Data relating to occupation, history of smoking and trauma, presence of diabetes, hypertension, serum cholesterol (which includes total cholesterol, triglycerides, LDL and HDL) and serum vitamin D levels, if available in the hospital information system were documented. Any association between these factors and rotator cuff tear was assessed.

Biceps:

1. Tendinopathic changes:
    - Ultrasound had a high negative predictive value (94.92%) and relatively high accuracy (86.57) for the diagnosis of tendinopathic changes in the biceps tendon.
    - Ultrasound was not very sensitive to diagnose tendinopathic changes in the biceps tendon (40% sensitive); however it was specific (90.32%).
    - There was significant association between gender, age and presence of hypertension for the presence of tendinopathic changes in the biceps tendon.
2. Fluid along the biceps tendon:
    - Ultrasound was fairly sensitive for the diagnosis of fluid along the biceps tendon (75.76%) sensitivity; however it was not be specific (33.33%).

- Positive and negative predictive values were 51.02% and 60% respectively with the accuracy been 53.62%.
- No variable was significantly associated with fluid along the biceps tendon.

3. Dislocation of the biceps tendon:
    - Ultrasound was not sensitive for the diagnosis of biceps tendon dislocation (33.33% sensitivity); but had high specificity (95.38%).
    - Positive and negative predictive values were 25% and 96.88% respectively with the accuracy been 92.65%.
    - No variable was significantly associated with dislocation of the biceps tendon.

Subscapularis Tendon:

1. Tendinopathic changes:
    a. Ultrasound had a good negative predictive value (82.61%) with a weak positive predictive value (46%) for the diagnosis of tendinopathic changes in the subscapularis tendon.
    b. Ultrasound was not very sensitive for the diagnosis for tendinopathic changes in the subscapularis tendon (sensitivity 58%); but it was moderately specific (74.51%).
    c. Accuracy of ultrasound was 70% for the diagnosis of tendinopathic changes in the subscapularis tendon.
    d. Occupation and presence of hypertension has a significant associated for the presence of tendinopathic changes in the subscapularis tendon.
2. Partial thickness tear of the subscapularis tendon:

a. Ultrasound has a good specificity and negative predictive value (83.87% and 91.23% respectively) for the diagnosis of partial thickness tear of subscapularis tendon with a good diagnostic accuracy (78.5%).
b. Ultrasound had poor sensitivity and positive predictive value (at 38% and 23% respectively) for the diagnosis of partial thickness tear of subscapularis tendon.
c. No variable showed significant association with partial thickness tear of the subscapularis tendon.

Supraspinatus Tendon:

1. Tendinopathic changes:
    a. Ultrasound had a good positive predictive value (83%) but a weak negative predictive value (50%) with diagnostic accuracy of 70.10%.
    b. Ultrasound had moderate sensitivity and specificity (73% and 63.16% respectively) for the diagnosis of tendinopathic changes in the supraspinatus tendon.
    c. Age and presence of hypertension had significant association with tendinopathic changes of the supraspinatus tendon.
2. Any tear of the supraspinatus tendon:
    a. Ultrasound has a good sensitivity and specificity (84% and 78.79% respectively) for the diagnosis of any tear of the supraspinatus tendon.
    b. It also has a good positive predictive value (89%), negative predictive value been 74.29% with diagnostic accuracy of 81.43%.
    c. There was significant association of age and presence of hypertension for the diagnosis of any supraspinatus tendon tear.
3. Partial thickness Vs full thickness supraspinatus tendon tear:

a. Ultrasound was good at diagnosing partial thickness tear (diagnosing 18 out of 19 such tear). It miss diagnosed one partial thickness tear as full thickness tear.
b. Ultrasound diagnosed only 5 full thickness tear out of 12 such tears. It miss diagnosed the remaining 7 full thickness tears as partial thickness tear.

Infraspinatus Tendon:

1. Tendinopathic changes:
    a. Ultrasound had a high specificity and negative predictive value (80.36% and 86.54% respectively) for the diagnosis of tendinopathic changes in the infraspinatus tendon.
    b. It had a poor sensitivity and positive predictive value (36% and 27% respectively)
    c. No variable showed significant association for the presence of tendinopathic changes in the infraspinatus tendon.
2. Tear in the infraspinatus tendon:
    a. Ultrasound showed good specificity and negative predictively value for the diagnoses of infraspinatus tendon tears (93.65% and 95.16% respectively) and a good diagnostic accuracy (90%).
    b. It has a weak sensitivity and positive predictive value (57% and 50%) respectively.
    c. There was no significant associated between different variables and presence of infraspinatus tendon tear.

Diagnosis of any tendon tear of subscapularis, supraspinatus and infraspinatus tendons:

1. Ultrasound had a fairly good sensitivity (73.08%) and specificity (88.39%) for the diagnosis of any tendon tear of the rotator cuff group of muscles.
2. Ultrasound had a good negative predictive value (90.73%) but moderate positive predictive value (67.86%).
3. Diagnostic accuracy of ultrasound was 84.54% for the diagnosis of any tendon tear.

Subacromial and Subdeltoid Bursitis:

1. Ultrasound had a good sensitivity (81%) and positive predictive value (76%) for the diagnosis of subacromial and subdeltoid bursitis.
2. Ultrasound has weak negative predictive value (50%) and a poor specificity (42.86%); while the diagnostic accuracy was 69.57% for the diagnosis of subacromial and subdeltoid bursitis.
3. There was significant association between age of the subjects and past history of trauma with the presence of subacromial and subdeltoid bursitis.

Acromio-Clavicular Joint Arthritis:

1. Ultrasound had a good sensitivity (78.95%) and moderate specificity (70%).
2. It had a good positive predictive value (93.75%) but poor negative predictive value (36.84%)
3. Diagnostic accuracy was 77.61%.

While previous studies had shown significant association between age (1)(2), hypertension (12), male gender, dominant arm, occupation (2), trauma (7)(8) and diabetes (17) with the presence of rotator cuff tear; our study showed significant association between presence of

tendinopathic changes in the biceps tendon and gender, age and hypertension. Occupation and hypertension were significantly associated with presence of tendinopathic changes in the subscapularis tendon. While age and hypertension had significant association with tendinopathic changes and presence of any tear in the supraspinatus tendon. No significant association was found between dominant arm, occupation, past trauma and presence of diabetes with the presence of rotator cuff tear. This may partly be related to smaller sample size. Trauma showed significant association with presence of only subacromial and subdeltoid bursitis in this study.

Although many studies have previously assessed sensitivity and specificity of ultrasound for the diagnosis of rotator cuff tear; the results have been mixed (Table: 14). This can partly be attributed to operator experience for performing shoulder ultrasound. Our studies shows a sensitivity of 73% and specificity of 88% for the diagnosis of any rotator cuff tears. The sensitivity is slightly lower than many of the other reported literature; however the specificity is better compared to those reported in the published literature.

Sensitivity and specificity of ultrasound to diagnose rotator cuff tears in few of the previously published studies:

Sr. No.	Study	Sensitivity	Specificity	Reference
1	Misamore 1991	33.00%	60.00%	(31)
4	Nicoletti 1994	81.00%	80.00%	(32)
2	Martin-Hervas 2001	71.00%	67.00%	(33)
3	Wallny 2001	74.00%	82.00%	(34)
5	De Candia 2002	91.00%	100.00%	(35)
6	Teefey 2004	97.00%	67.00%	(36)
7	Iannotti 2005	96.00%	80.00%	(37)
8	Sipola 2010	92.00%	45.00%	(38)
	Our Study 2014	**73.00%**	**88.00%**	

Table 14:

Conclusions:

1. Ultrasound has a good sensitivity (84%) and specificity (78.79%) for the diagnosis of any tear of the supraspinatus tendon. This is particularly important since supraspinatus tendon is the most commonly affected tendon among the rotator cuff group.

2. For the diagnosis of any rotator cuff tear; ultrasound showed a moderately good sensitivity (73.08%) and good specificity (88.39%).

3. Age and hypertension had a significant association with the presence of tendinopathic changes or presence of any tear in the supraspinatus tendon.

4. Ultrasound had a good sensitivity (81%) but poor specificity (42.86%) for the diagnosis of subacromial and subdeltoid bursitis. Age and history of trauma showed significant association with the presence of subacromial and subdeltoid bursitis.

5. Ultrasound had a fairly good sensitivity (78.95%) and specificity (70%) for the presence of acromio-clavicular joint arthritis.

Overall, ultrasound is a fairly good screening modality for the diagnosis of rotator cuff abnormalities, diagnosis of subacromion-subdeltoid bursitis and acromio-clavicular joint arthritis.

Limitations:

1. Our study involved a relatively small sample size of 70 subjects.
2. Ultrasound operator had newly acquired skill of performing shoulder ultrasound and therefore operator experience was inadequate.

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Annexure 1: Data collection sheet

Data collection sheet:

Sr. No.

Name:	-	
Hospital No:	-	
Gender:	-	0. Male, 1. Female
Age:	-	
Handedness:	-	0. Left, 1. Right
Occupation:	-	0. Manual (lifts heavy objects), 1. Office (light)
Smoking:	-	0. Yes, if yes, number of pack years, 1. No

History of trauma:

- Mode	-	0. At work, 1. Sports, 2. RTA, 3. Others
- Onset of symptoms	-	0. Before, 1. Within 1 week, 2. After 1 week

History of treatment:

- Medications	-	0. Yes, 1. No
- Physiotherapy	-	0. Yes, 1. No
- Joint injection	-	0. Yes, 1. No
- Operation	-	0. Yes, 1. No

Medical history / records:

- Diabetes	-	0. Yes, 1. No
- Hypertension	-	0. Yes, 1. No
- Hypercholesterolemia	-	0. Yes, 1. No
- Vitamin D level	-	0. Low, 1. Normal ( )
- On any medications	-	

Ultrasound findings:

Biceps tendon:

- Morphology - 0. Normal, 1. Bulky, 2. Not visualized
- Fluid along sheath - 0. Yes, 1. No
- Dislocation - 0.Yes, 1.No, if yes 2.During movement, 3. Partial, 4.Complete

Subscapularis:

- Morphology - 0. Normal, 1. Bulky
- Tear - 0. Yes, 1. No
- Type of tear - 0. Complete, 1. Partial
- Partial tear - 0. Along the fibres, 1. Perpendicular
- Dimensions of tears:
    - Horizontal -
    - Vertical -
    - Ant-posterior -
- Retraction of tendon -

Supraspinatus:

- Morphology - 0. Normal, 1. Bulky
- Tear - 0. Yes, 1. No
- Type of tear - 0. Complete, 1. Partial
- Partial tear - 0. Articular side, 1. Bursal side, 2. Rim rent, 3. Interstitial
- Dimensions of tears:
    - Horizontal -
    - Vertical -
    - Ant-posterior -
- Retraction of tendon -
- Impingement on dynamic movement - 0. Yes, 1. No

Infraspinatus:

- Morphology - 0. Normal, 1. Bulky
- Tear - 0. Yes, 1. No
- Type of tear - 0. Complete, 1. Partial
- Partial tear - 0. Articular side, 1. Bursal side, 2. Rim rent, 3. Interstitial
- Dimensions of tears:
    - Horizontal -
    - Vertical -
    - Ant-posterior -
- Retraction of tendon -

Subacromial subdeltoid bursa:

- Fluid present - 0. Yes, 1. No
- Synovial thickening - 0. Yes. 1. No

Rotator cuff interval:

- Fluid present - 0. Yes, 1. No

Posterior labrum:

- Visualized - 0. Yes, 1. No
- Morphology - 0. Normal, 1. Irregular

Head of humerus:

- Surface - 0. Smooth, 1. Irregular
- Cyst - 0. Present, 1. Absent

Glenohumeral joint fluid - 0. Present, 1. Absent
AC joint arthrosis - 0. Present, 1. Absent

MRI findings:

Biceps tendon:

- Morphology - 0. Normal, 1. Bulky, 2. Not visualized
- Fluid along sheath - 0. Yes, 1. No
- Dislocation - 0.Yes, 1.No, if yes 3. Partial, 4.Complete

Subscapularis:

- Morphology - 0. Normal, 1. Bulky
- Tear - 0. Yes, 1. No
- Type of tear - 0. Complete, 1. Partial
- Partial tear - 0. Along the fibres, 1. Perpendicular
- Dimensions of tears:
    - Horizontal -
    - Vertical -
    - Ant-posterior -
- Retraction of tendon -

Supraspinatus:

- Morphology - 0. Normal, 1. Bulky
- Tear - 0. Yes, 1. No
- Type of tear - 0. Complete, 1. Partial
- Partial tear - 0. Articular side, 1. Bursal side, 2. Rim rent, 3. Interstitial

- Dimensions of tears:
    - Horizontal -
    - Vertical -
    - Ant-posterior -
- Retraction of tendon -

Infraspinatus:

- Morphology - 0. Normal, 1. Bulky
- Tear - 0. Yes, 1. No
- Type of tear - 0. Complete, 1. Partial
- Partial tear - 0. Articular side, 1. Bursal side, 2. Rim rent, 3. Interstitial
- Dimensions of tears:
    - Horizontal -
    - Vertical -
    - Ant-posterior -
- Retraction of tendon -

Subacromial subdeltoid bursa:

- Fluid present - 0. Yes, 1. No
- Synovial thickening - 0. Yes. 1. No

Rotator cuff interval:

- Fluid present - 0. Yes, 1. No

Posterior labrum:

- Visualized - 0. Yes, 1. No
- Morphology - 0. Normal, 1. Irregular
- Labral tear - 0. Yes, 1. No
- Type of tear -

Head of humerus:

- Surface - 0. Smooth, 1. Irregular
- Cyst - 0. Present, 1. Absent

Glenohumeral joint fluid - 0. Present, 1. Absent
AC joint arthrosis - 0. Present, 1. Absent
Joint capsule - 0. Normal, 1. Thickened
Any other pathology -

Annexure 2: Consent form and data collection sheet in English

To assess the diagnostic accuracy of ultrasound for the detection of rotator cuff tear with respect to Magnetic Resonance Imaging (MRI) scan

PATIENT'S INFORMATION SHEET

Welcome to the Department of Radiodiagnosis at Christian Medical College, Vellore. Your doctor has referred you to our department to find out the cause of your shoulder problem / pain. You will be shortly undergoing MRI scan which will help us to find out the cause of your problem.

Presently we are doing a study in our department in which we are doing ultrasound scan for all the patients who are coming to us for MRI scan of their shoulder. By doing the ultrasound of shoulder we are trying to find the cause of your problem and comparing the findings with your MRI scan. We may also be able to find out additional problems as you cannot move your arm during the MRI scan; while you will be asked to move your arm during the ultrasound study and tell us where you have pain.

What is rotator cuff tear?
Our shoulder has four important muscle which form the rotator cuff. These muscles help to keep the joint in place. Because of trauma or advanced age there can damage to these muscles that can cause pain. In this study we will try to find if there is any damage to your muscles of shoulder joint.

If you take part in this study what will you have to do?
Patients who take part in this study will have to under ultrasound scan of their shoulder joint. During this time they will be asked to move their arm.

Is there any risk?
There is no risk to the patients involved in this study.

Will I have to pay for investigation?
Patients will not be charged for this investigation.

What advantage will you get from Study?
We will assess your shoulder when you move your arm. This might help us to find additional cause for you pain.

Will your personal details be kept confidential?
The results of this study will be published in a medical journal but you will not be identified by name in any publication or presentation of results. However, your medical notes may be reviewed by people associated with the study, without your additional permission.

Can you withdraw from this study after it starts?
Participation in this study is all voluntary; patient can withdraw from the study at any time. Refusal to participate will not involve any loss of benefits to which subject is otherwise entitled.

If you have any further questions, please ask Dr. Harshad Arvind Vanjare (04162283016) or email: harshadcmc2002@gmail.com

Informed Consent form

Study Title: To assess the diagnostic accuracy of ultrasound for the detection of rotator cuff tear with respect to Magnetic Resonance Imaging (MRI) scan

Study Number:

Subject's Initials: _____ Subject's Name: _____
Date of Birth / Age:_____

I_____, son /daughter of _____
Declare that I have read/been read to the information sheet provided to me regarding this study and have clarified any doubts that I had. [ ]
(Please tick boxes)
I also understand that my participation in this study is entirely voluntary and that I am free to withdraw permission to continue to participate at any time without affecting my usual treatment or my legal rights [ ]

I understand that the investigators of this study, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s) [ ]

I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable Representative:_____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____Date: _____/_____/_____

Study Investigator's Name: _____

Signature of the Witness: _____ Date:_____/_____/_____

Name of the Witness: _____

Annexure 3: Consent form and data collection sheet in Hindi

कंधे के रोटेटो कफ के नुकसान की अल्ट्रसाउंड से जाँच, और ऊसकी आम. अर्र. आई स्कॅन के साथ तुलना

रोगी जानकारी शीट

हम आप का क्रिस्चियन मेडिकल कॉलेज, वेल्लॉर रेडाइयालजी डिपार्टमेंट मे स्वागत करते है। आप के कंधे के प्राब्लम की जाँच के लिये आपके डॉक्टर ने आपको यहा भेजा है। थोड़े ही वक्त मे आपके कंधे का आम. अर्र. आई स्कॅन होगा। इस से आप के प्राब्लम को जानने मे हमे साहयता मिलेगा।

हम अपने डिपार्टमेंट मे अधायन कर रहे है उन मरीजोपे जो हमारे पास अपने कंधे का आम. अर्र. आई कराने आते है। उन मरीजो मे हम अल्ट्रसाउंड से जाँच करेंगे। इस अधायनके दवारा हम आप के कंधे के तकलीफ का कारण जानना चाहते है और इस का आम. अर्र. आई. स्कॅन के साथ तुलना करना चाहते है.

हो सकता है की हम एम.आर.आइ से अधिक जानकारी प्रपात कर सके क्योकी एम.आर.आइ स्कॅन मे अपना हाथ नहीं हिला सकते है, जबकि अल्ट्रसूनोग्राफी के दॉवराण आप को अपन् हाथ हिला कर बताना होगा की आप को दर्द कहा है।

रोटेटॉर कफ टियर क्या है?

हमारे कंधे मे चार मासपशिया होती है जो मिल कर रोटेटॉर कफ बनाती है। यह मासपशिया हमारे जोड़ को ऊसकी सही स्तिथि मे रखती है। किसी प्रकार के चोट या अधिक उम्र के कारण इन मासपेशियोंको नुकसान हो सकता है। हम इस अध्यनमे कंधे की इन मासपेशियोंमे किसी भी प्रकार के नुकसान को जानाने की कोशिश करेंगे।

इस अध्यन मे भाग लेने के लीये आप को क्या करना होगा?

जो मरीज इस अध्यन मे भाग लेंगे उनके कंधे का अल्ट्रसूनोग्राफी किया जायेगा। इसके दावरान उनको अपना हाथ हिलानेको कहा जायेगा।

क्या इससे किसी प्रकार का खतरा है?

इससे मरीजो को किसी भी प्रकार का खतरा नहीं है।

क्या मुझे इस जाच के लीये पयसे देने होंगे?

मरीजो को इस जाच केलीये कोई पैसा नहीं देना होगा।

आपको इस अध्यन से क्या लाभ होगा?

आप इस के दोरान अपना कंधा हीला सकते है, इस से हमे अधिक जानकारी मिल सकते है।

क्या आपका व्यागतिगत विवरण गोपनीया रखा जायेगा?

इस अध्यन से मिले परिणाम को किसी भी जर्नल मे प्रकाशित किया जायेगा, पर आपका नाम किसी भी जगह पर नहीं लिया जायेगा। परंतु, आपके चिकित्साल्य के रिकॉर्ड की समीक्षा हो सकते है उन लोगो के दवारा जो इस अध्यन से जुड़े है, और ये आपकी जानकारी के बेगार हो सख्ता है।

क्या आप इस अध्यन से अपना नाम वापस ले सकते है?

इस अध्यन स्वैचक है, आप इस अध्यन से अपना नाम कभी भी वापस ले सकते है। इस से आपका कोई भी नुकसान नहीं होगा।

किसी भी प्रकार की अधिक जानकारी के लेये कृपया संपर्क करे डाक्टर हर्षद अरविंद वंजारे **(04162283016)** या **email:harshadcmc2002@gmail.com**

कंधे के रोटेटो कफ के नुकसान की अल्ट्रसाउंड से जाँच, और ऊसकी आम.अर्र.आई (MRI) स्कॅन के साथ तुलना

अध्ययन में भाग लेने के के लिए सहमति

अध्ययन संख्या:
प्रतिभागी का नाम:
जन्म / Age की तारीख (वर्षों में):
हस्पताल नंबर:

मे_____ बेटा / बेटी _____
एलान करता हू की मैने जानकारी पत्र को पढ़ा है / इस जानकारी पत्र को मेरे लिये पढ़ा गया है, तथा मेरे सन्देहोंका स्पस्टीकरण किया गया है

मैं यह भी समजता हूँ कि इस अध्ययन में मेरी भागीदारी पूरी तरह स्वैच्छिक है और मुझे मेरे सामान्य उपचार और अपने कानूनी अधिकारों का ज्ञान है. में जनता हू की एस अनुमति को वापस लेने के लिए में स्वतंत्र हु और इससे मेरे इलाज पर कोई असर नहीं होगा

मैं समझता हूँ कि अध्ययन कर्मचारियों और संस्थागत नैतिकता समिति के सदस्यों को मेरे उपचार रिकॉर्ड को देखने के लिये मेरी अनुमति की जरूरत नहीं है और उसका ऊपयोग करने के लिय सहमती देता हू मैं समजता हू की इस अध्यन के परिनाऊ पर मेरा होई अधिकार नहीं होगा

मैं समझता हूँ कि मेरी पहचान किसी तीसरे पक्ष को जारी या प्रकाशित जानकारी में खुलासा नहीं किया जाएगा

मैं स्वेच्छा इस अध्ययन में भाग लेने के लिए सहमती देता हू

नाम:
हस्ताक्षर / अंगूठे का निशान
तिथि:

गवाह का नाम:
भागीदार के संबंध:
तिथि:

अन्वेषक का हस्ताक्षर:
तिथि:

Annexure 4: Consent form and patient information sheet in Tamil

எம்.ஆர்.ஐ ஸ்கேன் மூலம் கண்டறியப்படும் தோள் சுற்றுப்பட்டை கிழியல், அல்ட்ராசவுண்ட் ஸ்கேன் மூலமாக எவ்வளவு துல்லியமாக கண்டறிய இயலுமென்று நிர்ணயிக்க ஒரு ஆய்வு

நோயாளியின் தகவல் நகல்

கிறிஸ்தவ மருத்துவ கல்லூரியின் x-ரே பிரிவிற்கு உங்களை வரவேற்கிறோம். உங்கள் தோள்வலியின் காரணத்தை அறியும்படி உங்கள் மருத்துவர் உங்களை இந்த பிரிவிற்கு அனுப்பியிருக்கிறார். விரைவில், உங்கள் பிரச்சனைக்கான காரணத்தை அறியும்படி எம்.ஆர்.ஐ ஸ்கேன் செய்யப்படும்.
தோள்பட்டைக்கு ஸ்கேன் செய்ய வரும் ஒவ்வொரு நோயாளிக்கும், அல்ட்ராசவுண்ட் ஸ்கேன் செய்யும் ஒரு ஆய்வு எங்கள் துறையில் செய்யப்படுகிறது. அல்ட்ராசவுண்ட் ஸ்கேன் செய்வதன்மூலம், உங்கள் பிரச்சனையை அறிந்து, அதை ஒரு எம்.ஆர்.ஐ ஸ்கேனோடு ஒப்பிட்டுப் பார்க்க முயலுகிறோம்.
எம்.ஆர்.ஐ ஸ்கேன் செய்யும்போது, உங்கள் கைகளை அசைக்கமுடியாது. ஆனால், இந்த ஸ்கேன் செய்யும்போது, உங்கள் கைகளை அசைத்து வலி இருக்கும் இடத்தை சொல்லச்சொல்லுவோம். இதனால், இந்த ஸ்கேன் மூலமாக, கூடுதலாக பிரச்சனைகளை அறிய முடியலாம்.

தோள் சுற்றுப்பட்டை கிழிதல் என்றால் என்ன?

நம் தோள் சுற்றுப்பட்டையில் 4 முக்கிய தசைகள் உள்ளன. அவைகள் தோள் எலும்புகளை ஒன்று சேர்த்து வைக்கிறது. அடிபட்டாலோ, வயதாகும்போதோ, தோள் சுற்றுப்பட்டையிலுள்ள தசைகள் சேதப்படுவதினால், வலி ஏற்படும். இந்த ஆய்வில், உங்கள் தோள் மூட்டு தசைகளில் சேதம் இருந்தால் அதை கண்டுபிடிக்க நாம் முயற்சி செய்வோம்.

இந்த ஆய்வில் பங்கேற்க நீங்கள் என்ன செய்ய வேண்டும்?

இந்த ஆய்வில் பங்கேற்க, நோயாளிகள் தங்கள் தோள் மூட்டு அல்ட்ராசவுண்ட் ஸ்கேன் செய்ய வேண்டும். இந்த நேரத்தில், அவர்கள்

தங்கள் கையை நகர்த்த வேண்டியிருக்கும்.

இதனால் ஏதாவது ஆபத்துகளோ, பக்கவிளைவுகளோ உண்டா?
ஏதும் இல்லை.

இதற்கு பணம் செலுத்த வேண்டுமா?
இல்லை.

இதனால் உங்களுக்கென்ன நன்மை கிடைக்கும்?
உங்கள் கையை அசைத்துக்கொண்டே ஸ்கேன் செய்வதால் எம்.ஆர்.ஐ.-யி னால் கண்டறியக்கூடாத குறிப்புகள் அறியக்கூடும்.

உங்கள் தனிப்பட்ட விவரங்கள் ரகசியமாக வைக்கப்படுமா?
இந்த ஆராய்ச்சியின் விளைவுகள் மருத்துவ இதழ்களில் வெளியிடப்படும். இதற்கு உங்கள் மருத்துவ குறிப்புகளும் உபயோகிக்கப்படலாம். ஆனால் உங்கள் பெயரோ, மற்ற தனிப்பட்ட குறிப்புகளோ வெளியிடப்படாது.

இந்த ஆராய்ச்சியிலிருந்து பிறகு விலகிக்கொள்ளலாமா?
இதில் உங்கள் பங்கேற்பு தன்னார்வமானதே. எப்பொழுது வேண்டுமானாலும் நீங்கள் இந்த ஆராய்ச்சியிலிருந்து விலகிக்கொள்ளலாம். இதில் பங்கேற்க மறுத்தால் உங்கள் சிகிச்சையை அது எவ்விதத்திலும் பாதிக்காது.
மேலும் கேள்விகளுக்கு அணுகவும்:
Dr. ஹர்ஷத் அரவிந்த் வஞ்சாரே (04162283016)
ஈமெயில்: harshadcmc2002@gmail.com.

கிறிஸ்தவ மருத்துவ கல்லூரி

தலைப்பு: எம்.ஆர்.ஐ. ஸ்கேன் மூலம் கண்டறியப்படும் தோள் சுற்றுப்பட்டை கிழிதல் அல்ற்றா சவுண்ட் ஸ்கேன் மூலம் எவ்வளவு துல்லியமாக அறிய இயலுமென்று நிர்ணயிக்க ஒரு ஆய்வு

ஆய்வு எண் :

பங்கேற்போரின் பெயர்:

பிறந்த தேதி/ வயது:

கீழ்க்கண்ட இடத்தில் டிக் குறி இடவும்:

1. நான் _____ ஆம்தேதியில் தகவல் தாளைப் படித்து புரிந்துகொண்டேன். என் சந்தேகங்களை கேட்டு அறிந்து கொள்ளவும் எனக்கு வாய்ப்பளிக்கப்பட்டது.[ ]
2. இவ்வாய்வில் என் பங்கேற்பு முழுவதும் தன்னோர்வமானதென்றும் எந்த நேரத்திலும் நான் விலகிக் கொள்ளலாமென்றும் அறிந்திருக்கிறேன். இதனால் என் சிகிச்சையோ உரிமைகளோ எவ்விதத்திலும் பறிக்கபடாதென்று அறிகிறேன். [ ]
3. இவ்வாராய்ச்சி நடத்துபவரோ, அவரது சார்பாக வேறோரு நபரோ, நிர்வாக குழுவினரோ, அதிகாரிகளோ என்னுடைய கூடுதல் ஒப்புதல் இல்லாமல் இவ்வாய்விற்காக, என் மருத்துவ விவரங்களை உபயோகிக்க அனுமதிக்கிறேன். ஆனாலும் என் தனிப்பட்ட விவரங்கள் எவ்விதத்திலும் வெளியிடப்படமாட்டது என அறிகிறேன். [ ]
4. அறிவியல் முன்னேற்றத்திற்காய் இவ்வாய்வின் மூலம் அறியப்படும் எந்த தகவலையும் வெளியிட நான் தடை செய்யமாட்டேன் [ ]
5. இவ்வாய்வில் பங்குபெற நான் சம்மதிக்கிறேன். [ ]

பங்கேற்பவர்/ சட்டபூர்வ பிரதிநிதியின் கையொப்பம் :
தேதி:
பெயர்:

ஆய்வாளரின் கையொப்பம்:	சாட்சியின் கையொப்பம்:
தேதி:	தேதி:
பெயர்:	பெயர்

:

Annexure 5: Consent form and patient information sheet in Bengali

To assess the diagnostic accuracy of ultrasound for the detection of rotator cuff tear with respect to Magnetic Resonance Imaging (MRI) scan

রোগীর তথ্যসম্বলিত সূচী

আপনাকে সি এম সি'র রেডিও ডায়গানসিস বিভাগে স্বাগত। আপনার ডাক্তার আপনাকে আমাদের বিভাগে পাঠিয়েছেন আপনার কাঁধের সমস্যার জন্য। আপনাকে খুব তাড়াতাড়ি এম আর আই স্ক্যান এর মাধ্যমে সমস্যার কারণ সমন্ধে জানানো হবে।

বর্তমানে আমরা আপনাদের বিভাগের সমস্ত রোগীর আল্ট্রা সাউন্ড স্ক্যান করছি যারা আমাদের কাছে তাদের কাঁধের সমস্যা MR করতে আসছে।এইভাবে আমরা আপনার সমস্যার কারণ খুঁজতে চেষ্টা করছি এবং সাথে সাথে আপনার হাত কে নড়াচ' া করতে বলা হবে এবং আপনার যন্ত্রনার জায়গা সমন্ধে জিজ্ঞাসা করা হবে।

রোটেটার কাফ টিয়ার কি ?
আমাদের কাঁধের চারটি গুরুত্বপূর্ণ পেশি আছে যা তৈরি করে রোটেটার কাফকে। এই পেশিগুলি সন্ধিকে তার জায়গায় রাখতে সাহায্য করে। ট্রমা অথবা বয়স এই পেশি গুলিকে ক্ষতিগ্রস্থ করে এবং ব্যথার কারন হয়ে দাঁড়ায়। এই পর্যালোচনায় আমরা চেষ্টা করব আপনার কাঁধের সন্ধিস্থলে কোনো ক্ষতি হয়েছে কিনা জানতে।

আপনি কি এই পর্যালোচনায় অংশগ্রহণ করতে চান ?
রোগী যারা এই পর্যালোচনায় অংশগ্রহণ করেন তাদের কাঁধের সন্ধিস্থলে আল্ট্রা সাউন্ড স্ক্যান করানো হয় এই সময় তাঁদের বাহু কে নড়াচড়া করতে বলা হয়।

এতে কি কোনো ঝুঁকি আছে ?
এই পর্যালোচনায় কোনো ঝুঁকি নেই।

আমাকে কি এই পরীক্ষার জন্য কোন ব্যয় করতে হবে ?
রোগীকে এর জন্য কোন ব্যয় ভার বহন করতে হবে না।

এই পরীক্ষা থেকে কি সুবিধা পাওয়া যেতে পারে ?
এর সাহায্যে আপনাকে কাঁধের পরীক্ষা করতে হবে যখন আপনি একে নাড়াচাড়া করেন।

আমার ব্যক্তিগত তথ্যপঞ্জি কি গোপন রাখা হবে ?
এই পরীক্ষার ফল একটি মেডিক্যাল জার্নালে প্রকাশিত হবে। কিন্তু আপনাকে কেউ সনাক্ত করতে পারবে না। আপনার মেডিক্যাল নোটস্ পুনরায় পর্যালোচনা করা হবে। এবং এর জন্য আপনার কাছ থেকে বাড়তি সম্মতি আদায় করা হবে না।

কেউ কি এই পরীক্ষা শুরু করার পর নিজেকে সরিয়ে নিতে পারে ?
এই পরীক্ষায় অংশগ্রহণ সম্পূর্ণ ভাবে ঐচ্ছিক। রোগী যে কোন সময় পরীক্ষা থেকে নিজেকে সরিয়ে নিতে পারে এবং অংশগ্রহণে অনিচ্ছুক ব্যক্তি কোন রকম সুবিধা থেকে বঞ্চিত হবেন না।

যদি আপনার বিশদে কোন জিজ্ঞাসা থাকে তবে আপনি দয়া করে ডঃ হর্ষদ অরবিন্দ ভানজারের সাথে যোগাযোগ করতে পারেন। (০৪১৬২২৮৩০১৬) বা ইমেল harshad cmc 2002@gmail.com।

রেডিও ডায়নসিস ডিপার্টমেন্ট সি এম সি ভেলোর, তামিলনাড়ু / জ্ঞাত সম্মতি কাগজ নং-
গবেষণার শিরোনাম ঃ যে সকল রোগীদের মুখে অথবা গলায় ক্যান্সার হয়েছে তাঁদের জন্য এই ধরনের এম আর আই স্ক্যান বা ডিফিউশন নামে পরিচিত বা ঐ সমস্ত রোগীদের রেডিয়েশান বা কেমথেরাপি সমন্ধে ভবিষ্যত বানী করতে পারে।

জ্ঞাত তথ্য ফর্ম

পর্যালোচনা শিরোনাম ঃ এম আর আই স্ক্যানের নিরিখে রোটেটার কাপটিয়ারের আলট্রা সাউন্ড পরীক্ষার মাধ্যমে নিখুঁত পর্যালোচনা

পরীক্ষা সংখ্যা ঃ

বিষয়ের স্বাক্ষর ঃ বিষয়ের নাম ঃ

জন্ম তারিখ / বয়স ঃ

আমি ..... পুত্র / কণ্যা ..... ঘোষনা করছি যে আমি পড়েছি বা আমাকে শোনানো হয়েছে তথ্যসম্বলিত কাগজ এই পর্যালোচনার সম্বন্ধে।

দয়া করে ঠিক সঠিক জায়গায় টিক চিহ্ন দিন

১) আমি নিশ্চিত যে আমি পড়েছি এবং বুঝেছি তথ্য সম্বলিত কাগজ তারিখ..... উপরিউক্ত বিষয়ে এবং বিষয় সমন্ধে প্রশ্ন করতে আমার সুযোগ হয়েছে।

২) আমি বুঝেছি যে এই বিষয়ে অংশগ্রহণ আমার ঐচ্ছিক ব্যাপার এবং আমি যে কোন সময় কোন কারণ না দেখিয়ে কোন ডাক্তারি পরামর্শ ছাড়াই এবং আমার আইনি অধিকারের কোন ক্ষতিসাধন না করে নিজেকে সরিয়ে নিতে পারি।

৩) আমি বুঝি যে এই ডাক্তারি পরীক্ষায় প্রযোজক অথবা অন্যরা যারা প্রযোজনার পক্ষে ভাল কাজ করে, এথিকস্ কমিটি এবং রেগুলেটারি কর্তৃপক্ষের আমার কাছে কোনো অনুমতি পত্রের প্রয়োজন নেই আমার স্বাস্থ্য বিষয়ক তথ্য সমন্ধে এমনকি যদি আমি এই পরীক্ষা থেকে নিজেকেও সরিয়েও নিই।

৪) আমি আমার তথ্যকে সীমাবদ্ধ করতে রাজি নই এবং এই পরীক্ষা থেকে উদ্ভুত ফল কোন বিজ্ঞান ভিত্তিক কাজে লাগাতেও গররাজী নই।

৫) এই উপরে উল্লেখিত পরীক্ষায় আমি অংশগ্রহণ করতে চাই।

বিষয়ের স্বাক্ষর / আইনত গ্রহণযোগ্য

তারিখ ঃ

সিগনেটোরি বক্তির নাম ঃ

প্রতিনিধি ঃ

তারিখ ঃ

সিগনেটোরি নাম ঃ

তদন্তকারী / পরীক্ষকের নাম ঃ

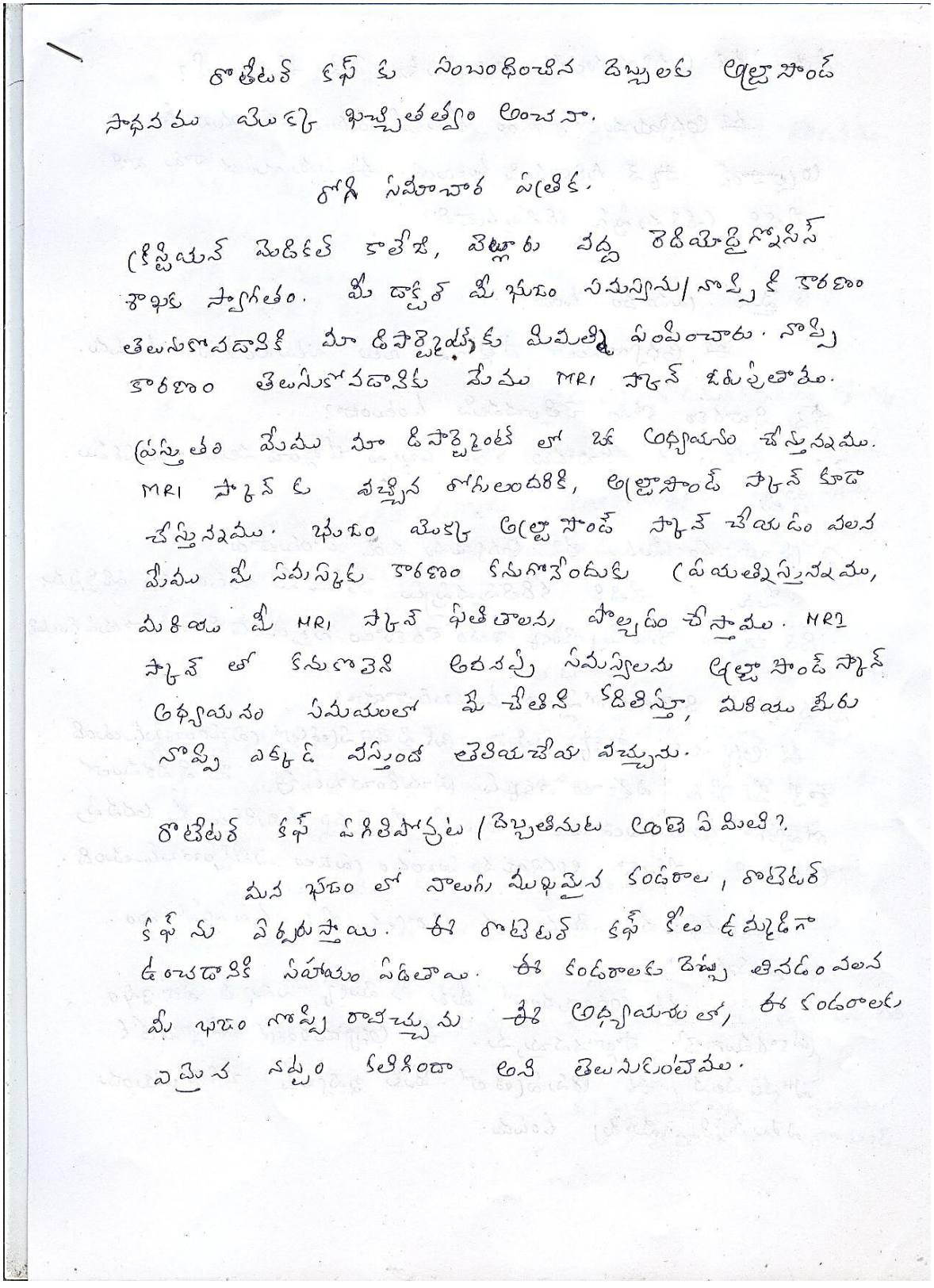
তারিখ ঃ

পরীক্ষকের নাম ঃ

সাক্ষীর স্বাক্ষর / বৃদ্ধাঙ্গুষ্ঠ ছাপ ঃ

তারিখ সাক্ষীর নাম এবং ঠিকানা ঃ

Annexure 6: Consent form and patient information sheet in Telugu



రొటేటర్ కఫ్ కు సంబంధించిన దెబ్బలకు అల్ట్రాసౌండ్ సాధనము యొక్క ఫిజ్జితత్వం అంచనా.

రోగి సమాచార పత్రిక.

క్రిస్టియన్ మెడికల్ కాలేజ్, వెల్లూరు వద్ద రెడియోడైగ్నోసిస్ శాఖకు స్వాగతం. మీ డాక్టర్ మీ భుజం పరిస్థితి/నొప్పి కి కారణం తెలుసుకోవడానికి మీ డిపార్ట్మెంట్ కు మిమ్మల్ని పంపించారు. నొప్పి కారణం తెలుసుకోవడానికి మేము MRI స్కాన్ చేయాల్సి ఉంటుంది.

ప్రస్తుతం మేము మీ డిపార్ట్మెంట్ లో ఒక అధ్యయనం చేస్తున్నము. MRI స్కాన్ కు వచ్చిన రోగులందరికి, అల్ట్రాసౌండ్ స్కాన్ కూడా చేస్తున్నము. భుజం యొక్క అల్ట్రాసౌండ్ స్కాన్ చేయడం వలన మేము మీ సమస్యకు కారణం కనుగొనేందుకు దోహదపడుతున్నము, మరియు మీ MRI స్కాన్ ఫలితాలను పోల్చడం చేస్తాము. MRI స్కాన్ తో కనుగొనలేని అదనపు సమస్యలను అల్ట్రాసౌండ్ స్కాన్ అధ్యయనం సమయంలో మీ చేతికి రాయడం జరుగుతుంది, మరియు మీరు నొప్పి ఎక్కడ వస్తుందో తెలియచేయవచ్చును.

రొటేటర్ కఫ్ పగిలిపోవడం/దెబ్బతినుట అంటే ఏమిటి?

మన భుజం లో నాలుగు మృదువైన కండరాలు, రొటేటర్ కఫ్ ను ఏర్పరుస్తాయి. ఈ రొటేటర్ కఫ్ కీలు ఉమ్మడిగా ఉంచడానికి సహాయం చేస్తాయి. ఈ కండరాలకు దెబ్బ తినడం వలన మీ భుజం నొప్పి రావచ్చును. ఈ అధ్యయనంలో, ఈ కండరాలు ఎంత మేర నష్టం కలిగిందో అని తెలుసుకుంటాము.

మీరు ఈ అధ్యయనంలో పాల్గొంటుకు ఏమి చేయలంటే?

ఈ అధ్యయనంలో భాగం తీసుకునే రోగులు వారి భుజంకీలు అల్ట్రాసౌండ్ స్కాన్ చేయించుకోవలసి ఉంటుంది. ఈ పరీక్షలో వారు వారి చేతిని ఎడిసిన్ వ్యాధి కదిలిస్తూ ఉంటారు.

ఏ మైన ప్రమాదం ఉందా?

ఈ అధ్యయనంలో పాల్గొన్న రోగులు ఎటువంటి హాని ఉండదు.

నేను విచారణ కోసం చెల్లించవలసి ఉంటుందా?

రోగులు ఈ విచారణ కోసం డబ్బులు చెల్లించ వలసిన అవసరము లేదు.

ఏ ప్రయోజనం మీరు ఈ అధ్యయనం నుండి పొందుతారు?

మీరు మీ చేతిని కదిలిస్తున్నప్పుడు మేము మీ కండరాలను పరిక్షిస్తాము దీని ద్వారా మీ నొప్పి యొక్క ఇతర కారణాలు నిర్ణించడానికి సహాయపడుతుంది

మీ వ్యక్తిగత వివరాలు గోప్యంగా ఉంచబడతాయా?

ఈ అధ్యయనం యొక్క ఫలితాలు ఒక వైద్య పత్రికలో ప్రచురించబడుతుంది కాని మీ పేరు, వివరాలు ఎక్కడ ప్రచురించబడవు. మీ వివరములు గోప్యంగా ఉంచబడుతాయి. అయితే మీ వైద్య గమనికలు మీ అనుమతి తో ఈ అధ్యయనం సంబంధం వ్యక్తులు పరిశీలించబడుతుంది.

ఈ అధ్యయనం మొదలయిన తర్వాత మీరు ఉపసంహరణం తీసుకోవచ్చునా?

ఈ అధ్యయనంలో మీరు మీ యొక్క సమ్మతి లేదా ఇష్టం ప్రకారముగానే పాల్గొనవచ్చును. ఈ అధ్యయనంలో పాల్గొనక పోవడం వలన, ఈ ఆసుపత్రిలో మీకు ఇవ్వబడే చికిత్సయందు ఎటువంటి మార్పు ఉండదు.

సమ్మతిని తెలుపు పత్రము.

రొటేటర్ కఫ్ కు సంబంధించిన డెస్సులకు అల్ట్రాసౌండ్ పరీక్షల యొక్క ఖచ్చితత్వం అంచనా.

అధ్యయనం నంబరు —
రోగి వివరములు — రోగి పేరు
చేతిన తోడి / వయసు.

నేను _____ (మీ పేరు), కొడుకు/కూతురు యొక్క _____ ఈ అధ్యయనం సంబంధించిన సమాచారమును చదివి ఉన్నాను మరియు అర్థం చేసుకొని ఉన్నాను. ఈ పరిశోధనకు సంబంధించి నా సందేహములన్నియు నివృత్తి చేసుకొనియున్నాను [ ]

ఈ పైను చూపించిన స్థలములో 'y' లేదా 'x' అని వ్రాయండి.

ఈ పరిశోధనలో నేను నా యొక్క సమ్మతి లో మరియు వ్రాత్మ ఇష్ట ప్రకారముగానే పాల్గొనుచున్నానని యు నాకు అర్థము అయినది. ఈ అధ్యయనం మొదలు అయిన తర్వాత ఏ సమయంలో అయినా నేను వైదొలగదలచిన అందుకు ఏ కారణము చూపించకుండానే ఇందులోని లిఖిత పత్రి లో నాకు ఇవ్వబడే చికిత్స యందు ఎటువంటి మార్పు ఉండదనియు నా న్యాయపరమైన హక్కుల యందు ఎటువంటి ఉల్లంఘన జరగదనియు నాకు అర్థం అయినది.

[ ]

ఈ పైన చూపించిన స్థలములో 'y' లేదా 'x' అని వ్రాయండి

ఈ అధ్యయనము మొదలు అయిన తర్వాత నేను ఈ అధ్యయనము నుంచి వైదొలగిన ఈ పరిశోధన చేయు పరిశోధనకర్తలకు మరియు, ఇటువంటి పరిశోధనలు యందు ఆసుపత్రిలో రోగుల పట్ల నైతిక బాధ్యత వహించు అధికారుల యొక్క కమిటీకి, మరియు ఇతర నిబంధనలు అధికారులకు నా అనుమతి లేకుండానే నా ఆరోగ్యమునకు సంబంధించిన వివరములు పొందుటకు, ఈ ప్రస్తుత పరిశోధనలో కానీ మరియు ఈ అధ్యయనమునకు సంబంధించి భవిష్యత్తులో చేయబోయే ఏ ఇతర పరిశోధనకు గాని నా ఆరోగ్యపరమైన వివరములను పొందుకొనుటకు నేను ప్రత్యేక ఇష్టములతో సమ్మతిని ఇచ్చుచున్నాను. నాకు సంబంధించిన వ్యక్తిగత మరియు ఆరోగ్యపరమైన వివరములను పరిశోధనాకర్తలు మరియు ఈ పరిశోధనకు సంబంధించి ఏ ఇతర అధికారులు గోప్యంగా ఉంచుతారని నేను అర్థం చేసుకుని, నా ఈ సమ్మతిని తెలుపుచున్నాను. [ ]

నాకు సంబంధించిన ఆరోగ్య వివరములను మరియు వ్యక్తిగత అధ్యయనం చాలా ఉత్పన్న యుక్తో ఎటువంటి భూతాలను కాలి వివరములను, N శాస్త్రీయ అక్షయమునకు పొందుకొనుటకు నా ప్రత్యేక ఇష్టములతో సమ్మతిని తెలియ చేయుచున్నాను. [ ]

నేను ఈ అధ్యయనం / పరిశోధనలో పాల్గొనటానికి ప్రత్యేక ఇష్టంతో నా సమ్మతిని తెలియ చేయుచున్నాను. [ ].

రోగి యొక్క సంతకము (లేదా వేలిముద్ర) / రోగికి సంబంధించిన చట్టం సంతకము (లేదా వేలిముద్ర). _____

తేది ___/___/___

సంతకము చేయు వారి పేరు _____

పరిశోధనకర్త సంతకము _____ తేది 1/1

పరిశోధనకర్త పేరు _____

నిష్పక్షపాత సాక్షి యొక్క సంతకము _____ తేది 1/1

నిష్పక్షపాత సాక్షి యొక్క పేరు _____

Annexure 7: Raw data

serial	hospital	gender	age	handedness	occupation	smoking	pack
1	631009f	0	48				
2	631198f	0	30				
3	632361f	0	74		0		
4	960711d	1	24				
5	008690f	0	32				
6	627257f	0	17				
7	637992f	1	21				
8	423924f	0	45		0	0	
9	643687f	1	37				
10	692326d	0	52		1		
11	653251f	0	47		1	1	
12	322654f	0	53			0	
13	469022f	0	26				
14	631458f	0	37				
15	680713f	0	21				
16	579667c	1	59				
17	702454f	1	46		1		
18	702775f	0	29				
19	714744f	0	38			1	
20	777040f	0	39				
21	785042f	0	57				
22	772546f	0	23	1	1	1	
23	264283f	0	32	1	1	1	
24	792703f	0	67	1	1	1	
25	958858a	1	47	1	1		
26	806016f	0	23	1	0	1	
27	701908a	0	52	1		1	
28	810654f	0	34			0	
29	813595f	0	45	1	0	1	
30	820134f	0	28	1	1	0	
31	819992f	1	52	1	1	1	
32	461522b	0	53		1		
33	823931f	0	50		1	1	
34	004727f	1	48	1	1		
35	016026c	0	37	1	1	1	
36	813520f	1	30	1	1		
37	728277f	0	38	1	1		
38	825249f	0	42	1		0	
39	609016c	0	22	1	1	0	
40	827221f	0	30	1	1	1	

41	830759f	0	39	1	1		
42	849456c	0	23	1	1	1	
43	541278a	1	52	1	1		
44	841550f	0	33	1	1	1	
45	849767f	0	41	1	1	1	
46	852638f	0	29	1	0	1	
47	274111d	0	24	1	1	1	
48	855242f	0	29	1	1	1	
49	828077f	0	24	1	1	0	2
50	863806f	0	31	1	0	0	3
51	858584f	0	32	1	1	1	
52	586413c	1	47	1	1		
53	872280f	0	55	1	0	0	3
54	878386f	1	41	1	1		
55	344844c	0	45	1	0	0	5
56	883420f	0	48	1	1	0	3
57	275430d	0	33	1	1	1	
58	161495f	0	64	1	1	1	
59	890001f	0	44	1	1	0	5
60	124071d	0	49	1	1	0	
61	153631d	1	61	1	1		
62	877127f	0	27	1	1	0	1
63	972382d	0	43	1	1	1	
64	899463f	0	31	1	1	1	
65	011969g	1	44	1			
66	853537b	1	57	1	1		
67	012086g	0	24	1	0	0	
68	012277g	0	27	0	0	1	
69	016141g	0	44	1	1		
70	018164g	0	45	1	1	1	

Trauma							
	history	mode	onset	medication	physiother	joint injection	operation
	0	1	0	0	1	1	1
						1	1
	1			0	1	1	1
	1						1
	1					1	1
	0	3	1			1	1
	1					1	1
							1
	0	2	1	1	1	1	1
	1						
	0	1	1			1	1
	0	1	1			1	1
							1
	1						
	1			0	1	0	1
	0	2	1				1
	1						1
	1						1
	1						1
	0	1	1	0	1	1	1
	0	0	1	1	0	1	1
	1	2	1	0	0	1	1
	1			0	0	1	1
	1			0	0	1	1
	1			0	0	0	1
	1				1	1	1
	0	3	1	1	1	1	1
	0	1		0	1	1	1
	1			0	1	1	1
	0	2	1				
	0	1	1	1	0	1	1
	1			0	1	1	1
	0	2	1		1	1	1
	1	2		0	1	1	1
	0	1	1	0	0	0	1
	1				1	1	1
	0	1	1	0	1	1	1
	1				1	1	1

	0	1	1	0	1	1	1
	0	3		0	0	1	1
	1			1	0	0	1
	0	3		0	1	0	1
	0	2	0	0	1	0	1
	0	0	1	1	0	0	1
	1			0	0	1	1
	1			1	1	1	1
	0	2	1	1	1	1	1
	0	3		0	1	1	1
	1			0	1	1	1
	1			0	1	1	1
	0	2	1	0	1	1	1
	1			0	0	1	1
	0	2	1	1	0	1	1
	1			0	1	1	1
	1				0	1	1
	0	3			1	1	1
	0	2	1	0	0	0	1
				0	1	1	1
	1			0	1	1	1
	1			0	1	1	1
	1			1	1	1	1
	0	1		1	1	1	1
	0	2			0	0	1
	0	3	0	0	0	0	1
	0	2	1	0	1	1	1
	0	1				1	1
	1					1	1
	0		1			1	1

diabetes	years	hypertensi		cholestero	total	triglyceri	ldl
1							
1		1		1			
				1			
1		1		1			
1		1		1			
				1			
				1			
0		1		1			
1				1			
1				0	210	273	133
1		1		1			
1		0		0	268	213	190
1		1		1			
				1			
				1			
1				1			
				1			
1		1		1			
1				1			
0		0		0	153	70	95
1		1					
1		1		1			
1		1		1			
1		1		1			
1		1		1			
1		0		0	143	136	99
1		1		1			
1		1		1			
1		1		1			
1		0		1			
1				0	167	84	124
1		1		1			
1		1		1			
0		1		0	170	163	121
1		1		1			
1				1			
1		0		0	164	203	102
1		1		1			

1		1		1			
1		1		1			
1		1		1			
0	1			0	158	146	112
1		1		1			
1		1		1			
1		1		0	136	108	93
1		1		1			
1		1		1			
1		1		1			
1		1		1			
1		1		0	170	177	118
1				1			
1		0		1			
1		1		0	113	84	72
1		0		1			
1		1		0	200	355	124
1		1		0	163	117	129
1		1					121
1		1		1			
1		1		0	161	83	118
0		0		0	187	220	116
1		1		1			
1		1		0	163	90	121
1		1		1			
1		1		0	199	260	123
1		1		1			
1		1		1			
1		1		1			
1		1		0	139	76	88
0		1		0	104	188	72

hdl	vldl		vitamin	level		shoulder
			0	24		1
			1			0
			1			0
			1			1
			1			0
			1			0
			1			0
			1			1
			0	17		0
33			0	10		0
			1			0
36			0	6		0
			1			0
			1			0
			1			0
			0	29		0
			0	22		0
			1			0
			1			0
			0	23		0
41			1			0
						1
			1			1
			1			1
			1			1
			0	14		0
28			0	20		0
			1			1
			1			1
			1			0
			0	23		0
36			1			1
			1			1
			0	30		0
30			1			0
			1			0
			1			0
38			1			0
			1			1

			1			1
			1			0
			1			1
37			0	31		1
			1			0
			1			0
27			1			0
			0	19		0
			1			0
			1			1
			1			0
32			1			0
			0	58		0
			1			0
36			1			0
			1			0
28			1			0
23			1			1
			1			1
			1			1
35			0	24		1
36			1			0
			1			1
33			0	28		1
			0	29		0
41			1			0
			0	8		1
			1			0
			1			1
47			1			1
26			1			0

USG	Biceps				Subscapularis	
		morphology	fluid	dislocatio		morpholog1
		0	0	1		0
		0	1	1		0
		0	0	1		1
		0	1	1		0
		0	0	1		0
		0	0	1		0
		0	0	1		0
		0	1	1		0
		0	1	1		0
		0	0	1		0
		0	0	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		0
		1	1	0		1
		0	1	1		0
		0	1	1		0
		1	0	1		0
		0	1	1		0
		0	0	1		0
		0	1	1		0
		0	1	1		0
		0	0	1		0
		0	1	1		0
		0	1	0		0
		1	1	1		0
		0	0	1		0
		0	1	1		1
		0	1	1		1
		0	0	1		1
		0	0	1		1
		0	1	1		0
		0	0	1		0
		0	0	1		1
		0	1	1		1
		0	0	1		1
		0	0	1		1

		0	1	1		0
		0	0	1		0
		0	0	1		0
		0	0	1		0
		0	0	1		0
		0	1			0
		0	0	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		0
		0	1	1		1
		1	0	1		1
		1	0	1		1
		0	0	1		0
		0	0	1		0
		0	0	1		1
			0			1
		0	0	1		0
				0		0
		0	0	1		0
		0	1	1		1
		0	1	1		0
		0	1	1		1
		0	0	1		1
		0	0	1		0
		0	1	1		0
		0	1	1		0
		0	0	1		1

			Supraspinatus				
tear	type	partial		morpholog2	tear1	type1	partial1
1				0	1		
1				0	1		
1					0	0	
1				0	1		
1				1	0	1	2
1				0	1		
1				0	1		
1				0	1		
1				1	0	1	1
1					0	0	
1				1	0	1	0
1				1	0	1	3
1				1	0	1	3
1				1	0	1	0
1				1	1		
1				0	1		
1				1	0	1	3
1				1	0	1	3
1				1	0	1	3
1				1	1		
1				1	0	1	0
1				0	1		
1				0	1		
1				1	1		
1				1	1		
1				0	1		
1				1	0	1	0
1				0	1		
0	1	0		0	1		
0	1	0		1	1		
0	1	0		1	0	1	1
0	1	0		1	0	1	0
1				1	1		
1				1	1		
1				1	0	1	0
0	1	0		1	0	0	
0	1	0		1	0	1	0
1				1	0	1	0

1				0	1		
1				1	0	1	0
1				1	1		
1				1	0	1	0
1				1	0	1	0
1				0	1		
1				1	0	1	1
1				0	0	1	3
1				1	1		
1				0	1		
1				1	1		
1				1	0	1	0
1				1	0	1	3
1				1	0	1	1
1					0	0	
1				1	0	1	0
0	1	0		1	0	0	
1				1	1		
1				0	1		
1				1	0	0	
1				1	0	1	0
1				1	0	1	0
1				1	0	1	3
1				1	1		
1				1	0	1	0
1				1	1		
1				1	1		
0	0			1	0	0	
1				1	1		
1				1	0	1	3
1				0	1		
1				0	1		

	Infraspinatus					SASD bursa	
impingemen		morpholog3	tear2	type2	partial2		fluid1
		0	1				1
0		0	1				1
			0	0			0
0		0	1				1
1		0	1				0
0		0	1				0
0		0	1				0
0		0	1				1
0		0	1				0
			0				1
0		0	1				0
0		1	0	1	2		0
0		0	1				1
0		0	1				0
0		0	1				1
0		0	1				1
0		0	1				0
0		0	1				0
0		0	1				0
		0	1				1
		0	1				0
0		0	1				1
0		0	1				1
		0	1				0
		0	1				0
0		0	1				1
0		0	1				0
0		0	1				0
0		0	1				1
		0	1				1
1		1	1				0
		0	1				0
		1	1				0
		0	1				1
		0	1				0
		1	1				0

		0	1				0
		1	1				0
		0	1				0
		0	1				0
		1	1				1
		0	1				0
		0	1				0
		0	1				1
		0	1				0
		0	1				0
		0	1				1
		0	1				0
		0	1				1
		0	1				0
		0	1				0
		0	1				0
			0	0			0
		1	0	1	2		0
		1	1				0
		0	1				0
		0	1				0
		1	0	0			0
		1	0	0			0
		0	1				1
		0	1				0
		0	1				0
		0	1				0
		0	1				0
		1	1				0
		0	1				0
		0	1				1
		0	1				0
		0	1				
		0	1				0

	Posterior labrum			**Humeral Surface**			**GH joint fluid**	**AC joint arthrosis**
synovial		superior	inferior		surface	cyst	glenohumer	ac
1					0	1	1	0
1					0	1	1	0
0		0	0		1	1	1	0
1		0	0		0	1	1	0
0		0	0		0	1	1	0
0					0	1	1	1
0		0			0	1	1	1
1					0	1	1	1
0					0	1	1	1
1					1	1	1	2
0		0			1	1	1	1
0		2			1	1	1	1
1		0			1	1	1	1
0					0	1	1	0
1		0			1	1	1	0
1		0	0		1	1	1	1
0		0	0		0	1	1	2
0		0	0		0	1	1	1
0		0	0		1	1	1	1
1		0	0		0	1	1	1
0					1	1	1	1
1		0			1	1	1	1
1		0			1	1	1	1
0		2			1	1	1	2
0		0			0	1	1	1
1		0	0		0	1	1	1
0		0			0	1	1	1
0		0			1	1	1	1
1		0			1	1	1	1
1		0	0		1	1	1	1
0		2	0		1	1	1	1
0		0	0		1	1	1	1
0		0	0		1	1	1	1
1		0	0		1	1	1	1
0		0	0		0	1	1	

0		0	0		1	1	1	1
0		0	0		1	1	1	1
0		0	0		1	1	1	1
0		0	0		1	1	1	1
0		0	0		1	1	1	2
1		0	0		0	1	1	1
0		0	0		1	1	1	1
0		0	0		1	1	1	1
1		0	0		0	1	1	1
0		0	0		1	1	1	1
0		0	0		1	1	1	1
1		0	0		0	1	1	1
0		0	0		1	1	1	1
1		0	0		0	1	1	0
0		0	0		0	1	1	1
0		0	0		0	1	1	1
0		0	0		0	1	1	1
0		0	0		1	1	1	1
0		2	0		1	0	1	
0		1	0		1	1	0	1
0		0	0		1	1	1	1
0		0	0		1	1	1	1
0		1	0		1	1	1	1
0		0	0		1	1	1	0
1		0	0		0	1	1	1
0		0	0		0	1	1	1
0		0	0		1	1	1	1
0		0	0		0	1	1	1
0		0	0		0	1	0	1
0		0	0		1	1	1	1
0		0	0		1	1	1	
1		0	0		0	0	1	1
0		0	0		0	1	1	1
		0	0		0	1	1	1
0		0	0		0	1	1	0

MRI	Biceps				Subscapularis			
		morpholog4	fluid2	dislocati1		morpholog5	tear3	type3
		0	1	1		0	1	
		0	1	1		0	1	
		1	0	1		1	0	1
		0	1	1		0	1	
		0	0	1		0	1	
		0	1	1		0	1	
		0	1	1		0	1	
		0	0	1		1	1	
		0	0	1		0	1	
		0	0	1		1	0	1
		0	0	1		0	1	
		0	0	1		0	1	
		0	1	1		0	1	
		0	0	1		1	0	1
		0	1	1		0	1	
		1	0	0		1	0	0
		0	0	1		0	1	
		0	0	1		0	1	
		0	0	1		1	0	1
		0	0	1		1	0	1
		1	0	1		1	1	
		0	0	1		0	1	
		0	1	1		0	1	
		0	0	1		0	1	
		0	1	1		0	1	
		0	1	1		0	1	
		0	0	1		0	1	
		0	0	1		0	1	
		0	0	1		1	1	
		0	0	1		0	1	
		0	0	1		1	0	1
		0	0	1		0	1	
		0	1	1		0	1	
		0	0	1		0	1	
		0	0	1		0	1	

		0	0	1		0	1	
		0	0	1		0	1	
		0	1	1		1	0	1
		0	0	1		0	1	
		0	1	0		0	1	
		0	0	1		0	1	
		0	0	1		0	1	
		0	0	1		0	1	
		0	0	1		0	1	
		1	0	1		1	0	1
		0	0	1		0	1	
		0	1	1		0	1	
		0	1	1		0	1	
		0	1	1		0	1	
		0	0	1		0	1	
		0	0	1		0	1	
		1	1	1		1	1	
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		1	0	1		0	1	
		0	0	1		1	0	1
		0	0	1		0	1	
		0	1	1		0	1	
		0	0	1		1	1	
			0	0		0	1	
		0	1	1		1	1	
		1	0	1		1	1	
		0	1	1		0	1	
		0	0	1		0	1	
		0	0	1		0	1	
			0	0		1	1	
		1	0	0		1	0	0
		0	0	1		1	1	
		0	0	1		1	0	1
		0	0	1		1	1	
		0	0	1		1	0	1

	Supraspinatus						Infraspinatus
partial3		morpholog 6	tear4	type4	partial4	impingeme 1	
		1	1			0	
		1	1			0	
2		1	0	0			
		0	1			0	
		1	0	1	2	0	
		0	1			0	
		0	1			1	
		1	0	1	3	0	
		1	0	0		0	
2		1	0	0			
		1	0	1	0	0	
		1	0	1	1	0	
		0	1			0	
2		1	0	1	3	0	
		0	1			0	
		1	0	0			
		1	0	1	3	0	
		1	0	1	0	0	
2		1	0	1	0	0	
2		1	0	1	3		
		1	0	0			
		0	1			0	
		0	1				
		1	0	1	3		
		0	1				
		0	1				
		1	0	0			
		0	1				
		0	1				
		0	1				
0		1	0	0			
		1	0	1	3		
		0	1				
		1	1				
		1	0	0			

		1	1				
		0	0	1	3		
0		1	0	1	0		
		0	1				
		0	1				
		1	1				
		1	0	1	0		
		1	0	1	1		
		1	1				
0		1	0	0			
		1	0	1	1		
		0	1				
		0	1				
		0	1				
		1	0	1	0		
		1	1				
		1	0	1	1		
		1	0	0			
		1	0	0			
0		1	0	1	0		
		1	1				
		0	1				
		1	0	0			
		1	0	1	0		
		1	0	1	3		
		1	0	1	0		
		0	1				
		0	1				
		0	1				
		1	1				
		1	0	0			
		1	1				
0		0	1				
		1	1				
0		0	1				

				SASD Bursa			Posterior labrum
morpholog 7	tear5	type5	partial5		fluid3	synovial 1	
0	1				0	0	
0	1				0	0	
1	0	0			0	0	
0	1				0	0	
0	1				0	0	
0	1				1	1	
0	1				1	1	
0	1				1	1	
0	1				0	0	
1	0	0			0	0	
0	1				0	0	
0	1				0	0	
0	1				1	1	
0	1				0	0	
0	1				0	0	
1	0	0			0	0	
0	1				0	0	
1	1				1	1	
1	0	1	2		0	1	
0	1				1	1	
1	1				0	0	
0	1				1	1	
0	1				1	1	
1	1				0	0	
0	1				0	0	
0	1				0	0	
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0	1				1	1	
0	1				1	1	
0	1				1	1	
1	1				0	0	
0	1				0	0	
0	1				1	1	
0	1				0	0	
0	1				0	0	

0	1				0	0	
0	1				1	1	
1	0	1	0		0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
1	1				0	0	
0	1				1	1	
1	1				0	0	
0	1				0	0	
0	1				0	0	
1	0	0			0	0	
0	1				0	0	
0	1				0	0	
1	1				0	0	
0	1				0	0	
1	0	0			0	0	
0	1				0	0	
0	1				0	0	
0	1				0	0	
1	0	1	2		0	0	
0	1				1	1	
0	1				1	1	
1	1				0	0	
1	1				0	0	
1	1				1	1	
0	1				0	0	
0	1				0	0	
0	1				0	0	

		Humeral head			**GH joint fluid**	**AC joint arthrosis**
superior1	inferior1		surface1	cyst1	glenohume1	ac1
0	0		1	0	0	1
0	0		0	1	1	0
0	0		1	1	0	1
0	0		0	1	0	0
0	0		0	1	1	0
0	0		1	0	1	0
0	0		0	1	1	0
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